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Exploring the Significance of Social Influences on Epistemic Beliefs

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EXPLORING THE SIGNIFICANCE OF SOCIAL INFLUENCES ON EPISTEMIC BELIEFS

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Education
at the University of Kentucky

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ABSTRACT OF DISSERTATION

EXPLORING THE SIGNIFICANCE OF SOCIAL INFLUENCES

ON EPISTEMIC BELIEFS

This document proceeds from an interest in applying theories of student development to higher education policy. The process sobered me from idealistic expectations of profundity to focus on adding relevant building blocks to the established foundation of epistemological development. Progress was found in moving toward clarifying what happens during the change process as a student moves from naïve to mature beliefs. Lead forth out of this ambiguity, unearthing the nature of social influences as a player in the developmental process became a target of this work.

Moving toward a deeper understanding of how concepts of attachment, naiveté, authority, and potential loss interface with epistemological development are at the core of this enterprise. The following is a quantitative analysis using a self-report survey to explore the interaction between social influences and the development of epistemological beliefs. The methodology uses students' impressions of themselves to create a factor structure based on theory from previous research. The emerging limitations are both related to student perspective and the enigmatic nature of developmental measurement. The resulting claims keep these limitations in view with an eye toward conclusions that relate to defining factors. For example, the nature of authority was found to fit better as a source of knowledge rather than a social influence. Also, the factor of Social Accord emerged as a consistent influence on development.

The results show that social influences and the development of epistemic beliefs are negatively related and the statistical significance of the analysis suggests the value of further exploration into the relationship between the two constructs. However, even more clarity is needed to accurately define epistemic beliefs, how they could be best measured quantitatively, and how social influences are composed. This project is a step along that building process.

KEYWORDS: Epistemological Development, Social Influences, Epistemic Beliefs, Cognitive Development, Educational Psychology

EXPLORING THE SIGNIFICANCE OF SOCIAL INFLUENCES ON EPISTEMIC BELIEFS

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This dissertation is dedicated to my children, Michayla and Gabriel,
and my siblings, Genelle, Dodd and Steve.

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Introduction

Simply look out a high-rise window of a professor's office and you will see the emphasis on building across campus. Torn up roads and demolished residence halls are the evidence of progress. Buildings that housed memories of the wonder years of professional women and men across our state and world are now piles of rubble. In the competitive world of higher education, there is no doubt that a plan for the future is necessary. Student retention and recruitment are high priorities, so state of the art renovation is happening for good reason. A local radio ad boasts that a new freshmen class is the largest and most accomplished to date. Growth mingles with the dust in the air outside the windows.

Less obvious, in underpublicized meetings among campus leaders, discussions about increasing the quality of education are also taking place. This campus, along with most others across the United States, has a mission statement that includes a declaration for the need to graduate critical thinkers. The benefits of buildings can be measured by bottom lines and their features can be explained to students anticipating the joys of college life. More abstractly, educational theory can illustrate the need for solid evaluation leading toward the cognitive advancement of students.

This is the background of epistemological study for higher education, which examines the way beliefs about knowledge influence opinion, acquisition, and justification. It can help educational strategists become more mindful of what kinds of cognitive foundations are being established. As a parent with a child soon to become a college student, I am one of many interested in knowing how my child, and the peers she

will interact with, will be cognitively challenged on her campus. Parents, professors and administrators alike can all benefit from guidance in navigating discussions about how cognitive development can influence curriculums and pedagogies. Studies about epistemology have attempted to contribute to these discussions. Despite such attempts, epistemology continues to be enigmatic. Increased efforts need to be made into analyzing how epistemic beliefs are developed, tracked and measured. While defining the boundaries of development can be challenging, discussing how cognitive and epistemological development can be measured will start conversations that lead to strategies about building more qualified graduates, thus meeting university missions. This study is an exploratory attempt to start such a conversation by unpacking the tradition of measurement of educational epistemological development.

As a five-year graduate assistant in residence life, I know first-hand that social gatherings, chance meetings at orientation sessions, and classroom laughter fill the imaginations of incoming students. The university is indeed building buildings, but it is also shaping minds and serving as an environment for forming relationships. Measuring cognitive growth would be much simpler in a social vacuum. Epistemological developmental studies have begun to unearth contextual effects on growth, change, and the way doubt is managed (Baxter Magolda, 2004; Bendixen & Rule, 2004; Pizzolato, 2005; Pizzolato, Ngyuen, Johnston, & Wang, 2012). Continued discussion about how developmental processes operate within social realms needs to progress. Examining the processes of interaction between epistemological growth and social context is the primary goal of this study.

After investigating multiple theories on college student development, primarily originating from the landmark work of William Perry (1970), I found that researchers continually called for more detailed investigations into the process of cognitive change. However, while epistemological development is related to cognitive development, there are some differences. One of significance is that epistemology, because it deals more directly with specific beliefs, lends itself more to a detailed analysis of the change process. The construct of personal epistemology has consistently included beliefs about (a) the certainty of knowledge, (b) the simplicity of knowledge, (c) the source of knowledge, and (d) the justifications for knowing (Pintrich, 2002). This study is an attempt to explore that foundation and clarify the way in which social influences are involved in epistemological development. A further goal is to situate epistemology within the broader field of cognitive development. While both developmental processes are generally described as moving from subjective to increasingly more objective viewpoints, epistemology can more easily be framed to describe and analyze particular beliefs about knowledge and therefore what specifically occurs during change. Furthermore, epistemological development has been more thoroughly qualitatively than quantitatively tested. While qualitative measures have proven to be more helpful in determining the nuances of development, particularly for measuring broad shifts, they lack the detail required to outline specific change processes. A definitive, reliable, quantitative measure still eludes researchers.

Some studies have exposed the tenuous nature of epistemological constructs (Schraw, Bendixen, & Dunkle, 2002; Welch & Ray, 2013; Wheeler, 2007). The role of social interaction has added to the confusion. Exploring the ways social, environmental

forces like authority, relational attachment and fear of loss influence epistemological development may clarify more measurable aspects of epistemic beliefs. These particular social influences, which have more clearly emerged in the literature as potential factors in development, will be examined through a quantitative measure to test and verify ways in which socially created predispositions toward knowledge inhibit or promote epistemological change. The nature of the existence of these social influences and their affect on epistemic growth will be examined to help refine measurement strategies, which is a necessary foundational step that can reveal eventual applications for higher education.

Statement of the Problem

Various factor analyses of epistemic beliefs have yet to produce a strong measurement device of the constructs of epistemology (Welch & Ray, 2013). Marlene Schommer's (1990) initial Epistemological Questionnaire (EQ) has been shaped and reshaped because it was difficult to replicate her results. New forms of the questionnaire have also failed to produce consistent confidence for quantitative measurement. The construct has been adjusted, offering better results, but it continues to produce less than desirable levels of reliability.

Researchers are also calling for a clearer understanding of the details of the change process. This is a continually evolving practice of bringing clarity to a somewhat nebulous concept. The assessment of social influences as important drivers or inhibiters of the process may provide a step toward a more accurate understanding of epistemological development.

Purpose of the Study

Most higher education institutions claim to enhance the growth of students as critical thinkers. A more readily reproducible measure of epistemological beliefs is needed to explore the relationship between epistemology and learning, particularly as it pertains to college students. The construct of epistemology is becoming more useful for evaluating educational processes, and this study hopes to explore possible ways to assist in validating it through responsible measurement. Social elements have continued to skew the results of these measurements. Providing a theoretical foundation that adds to the explanation of the effects of social influences, operationalizing them and measuring them separately for analysis are the purposes of this study. With a valid measurement of the impact of social influences on beliefs and greater insight into factors that influence development, epistemology can be more usefully applied to higher education.

Research Question

The material presented focuses upon the following research question: To what extent does a measure of authority, naïveté of attachment, and fear of loss as a result of change amongst college students help predict their level of epistemological development?

Theoretical Framework

This study emerged from explorations of cognitive development theory and epistemological development theory. Both processes were examined in depth to determine their relationship to each other. In particular, the way each describes change factors heavily in operationalizing the impact of social influences. The bioecological model (Bronfenbrenner, 1994) will also be examined as an alternative because of its useful definitions of the contextual processes active in development. As a result, the

theoretical framework of the study is centered on development, and change in particular, because it exposes the social factors involved in the process.

The literature also calls for more valid measurement because factor analyses from previous studies revealed that some epistemological beliefs "fell out" as aspects of the overall construct. Reshaping an overall construct of epistemic beliefs, while considering social influences, allows for the associations between the two to be explored. A quantitative measure of beliefs and subsequently, social influences, permits a factor analysis to determine the latent factors involved. These can then be examined to determine how specific interactions between them might mediate change. The history of quantitative measures of epistemological beliefs reveals clues about the best way to shape a theoretical construct of epistemic beliefs and social influences.

Epistemology as a modern concept has existed for over a century and ultimately dates back to ancient Greece. In 1854, James Frederick Ferrier first mentions the modern term in his work, Institutes of Metaphysic. Over time, the word has become interchangeable with the theory of knowledge. It encapsulates various philosophical fields such as justification, meta-philosophy, the structure of knowledge, and skepticism just to name a few. Insights emerging from epistemology have been applied to multiple fields including politics, aesthetics, and ethics, for example. The current study narrows the topic to explore ideas surrounding the development of epistemic beliefs of college students. As a result, epistemology is framed here to more directly explore conceptual change; and this quite apart from discussions about particular beliefs. The resulting analysis is targeted to bring eventual insight into higher education applications.

The way both the cognitive and epistemological developmental fields describe change reveals subtle, but important differences. While it is not the only way to see the relationship between the two sciences, cognitive development can be framed as a broader developmental process, and epistemological development as the evolution of specific beliefs about knowledge. Cognitive development theory uses the term dissonance to name the key factor in development while epistemological development employs doubt. Taking the ideas behind these terms further, epistemological change as initiated by doubt suggests there are social determinants are involved in the epistemological growth process.

Robert Kegan (1994) articulately captures the nature of cognitive growth and his theories have been appropriately applied to educational practice. His ideas form a coherent model for cognitive development and therefore provide a background for the study. His terminology describes growth as the mind's differentiation of itself from former perceptions. These differentiations form the basis for analyzing change.

Early researchers of cognitive and epistemological development contribute key concepts to the study. Thinkers such as William Perry (1970), Marlene Schommer (1990), Urie Bronfenbrenner (1994), Marcia Baxter Magolda (2004), Jane Pizzolato (2005), and others have provided a comprehensive language for discussing change, particularly as it reveals the significance of context as a factor.

The evolution of quantitative research for epistemology has contributed heavily to the emergence of social relationships as a factor in development. Marlene Schommer (1990) was the first theorist to produce a device specifically designed to measure epistemological beliefs. Unlike other researchers in the field, she wasn't convinced that interviews were the best way to measure epistemological beliefs, so she developed and

continually operationalized the Epistemological Questionnaire (EQ). Her five categories of beliefs established a construct that has been modified as other researchers examined her work. Resulting quantitative devices, such as the Epistemological Beliefs Inventory (EBI) in particular (Schraw et al., 2002), have shaped different aspects of the construct as they wrestled to reproduce Schommer's results. Various researchers have conducted factor analyses to determine an acceptable construct and measuring device for epistemological beliefs. Some measured aspects of epistemic beliefs did not replicate well and these limitations have continued to direct an overall, evolving study. These categories share a common thread, namely they are social in nature and converge in a general disposition toward change. Such categories will be used to operationalize social influences factors.

One of the only clear epistemological change models was catalogued by Lisa Bendixen and Deanna Rule (2004). They took theories, particularly from Barbara Hofer and Paul Pintrich (1997), and created a model that describes epistemic change with the components epistemic doubt, epistemic volition, and resolution strategies. This epistemic change model exposes the way in which social influences interact with general development. Hofer (2001), one of the leading theorists on epistemology, claims that development can be viewed from a global perspective – that people hold a general, over-arching approach to knowledge that is on a continuum from subjectivity to objectivity. She outlines how most research has examined epistemology from this perspective, but introduces insights that challenge previous understandings and inspires succeeding studies, suggesting that there are more "fine-grained" elements to be explored. Following Hofer's influence, David Hammer and Andrew Elby's study (2002) suggests the

existence of "epistemological resources," claiming that development is more context driven. In this sense, general epistemological schemes are composed of smaller groupings of perspectives shaped by resources. The nature of social influence can be defined, in part, by examining how these resources operate within a context.

To explore the significance of social, environmental factors, Bronfenbrenner's work on the bioecological model of development will be presented to gain insight into factors influencing the development of epistemic beliefs. His work lends itself to considering relationships as an ecological configuration of cultural influence. His model helps to reveal factors influencing developing epistemic beliefs and offers an alternative view on how they change as a student develops.

A study by David Long, Evolution and Religion in American Education: An Ethnography (2011), exposed the dynamic relationships between the origins of beliefs, epistemology and social relationships. Through extensive interviews with students, teachers, and professors, Long discovered that the teaching of evolution in high schools and colleges was being influenced by cultural maxims. After delineating particular ontological outlooks, he revealed the relationship between evolution education and ontological, epistemic perspectives, portending that a student's origin of beliefs trumps or motivates epistemology. Framed in this way, social influence can be described as a force that limits or encourages epistemic growth.

Significance of the Study

The present study examines the ways proposed social factors influence epistemological development. This is important because such an analysis may contribute to discovering ways epistemic beliefs operate within social contexts at universities and

colleges. Specifically, the way authority, naiveté of attachment, and fear of loss influence epistemic change may help improve our understanding of significant and desirable epistemic changes among college students.

The formation of constructs and their relationships with each other. This study is, in part, an attempt to clarify what encompasses epistemology and social influences. Before discussions about developmental change can take place, it is important to know what aspects of knowledge students are wrestling with. While researchers have begun to provide key arguments about what is taking place during epistemological development, few have been able to clearly define exactly what happens as students mature. In order to enter into discussion about how epistemology can be applied toward improvements in education, more needs to be known about the change process. Additionally, the theoretical framework provided allows a starting point for discussion about how the social contexts of students may influence the development of epistemic beliefs. Moving from theoretical concepts to specific measurement devices designed to evaluate developmental processes is a several step process. As concepts are operationalized through measurement, they take form. In addition to clarifying what exactly comprises epistemology and social influences, the relationships among constructs are explored and presented.

Measurement strategies. As these constructs emerge, it will become clearer how they can be, and need to be measured. Of particular interest for this study is the terminology that will be used to evaluate the constructs. The literature provides theoretical grounding for questions in the survey and the measurement device will in turn provide a testing ground for more accurate conversation. Resulting discussions should

propel the discourse about epistemology and social influences closer to application for higher educational processes. Furthermore, future studies can avoid the pitfalls encountered by a study that attempts to move from theoretical to operational grounds.

Chapter 2

Literature Review

The goal of this study is to explore the constructs of social influences and epistemic beliefs. The hope is that the factors that emerge and the way they relate will eventually provide insight into how both impact educational processes. Despite recent gains in understanding about epistemological development, consistent gaps in conceptualization and measurement still exist. More clarity about the nature of social influences as they relate to epistemic beliefs can reveal new understandings about the developmental process of those beliefs. Situating these potential constructs and conceptualizations of epistemology within a theoretical framework is the task of this section of the dissertation. Though other potential perspectives can be argued, for the purpose of this discussion, cognitive development is being framed as a broader developmental outlook, and epistemology as a narrower avenue for discussing change. The Bioecological Model (Bronfenbrenner, 1994) will also be presented because it more directly outlines the effects of context on developmental change. In response to the goals of this project, both cognitive and epistemological development will be examined with an emphasis on ways they address change and their histories of measurement. The refining process of measuring epistemic beliefs has clarified troublesome elements of its construction, and these results have begun to capture the emergence of social factors. Most studies have called for both a valid measure of beliefs and cautioned that any new tool must be theoretically grounded. This section presents some theoretical approaches to cognitive and epistemological change and the evolution of their measurement.

Robert Kegan's Cognitive Developmental Theory

Robert Kegan's theory is particularly relevant to the influence of social forces on cognitive change because he investigates the increasingly demanding cognitive expectations of society on individuals as they grow. Kegan's book, In Over Our Heads, (1994) was written in response to this increasingly "hidden curriculum." Kegan recognized the growing expectations on the cognitive abilities of people in Western societies and offered suggestions for environmental and therapeutic approaches in response. At their roots, his understandings rely heavily on the work of Jean Piaget (1932), the founder of modern cognitive development theory. However, particular elements of Kegan's theory are borrowed from Freudian theory and its subsequent offshoots, particularly Object Relations Theory and Neo-Freudian concepts. Consideration of these influences begins the conversation about how change is conceived in the present study. That discussion uncovers the nuances of the construct of cognitive development and shapes a background for the further consideration of how epistemic beliefs are influenced by social factors.

Freudian influence. The essential differences between what Kegan (1982) calls constructive-developmental processes and Freudian concepts of development emanate from the causes of growth. From a Freudian perspective, it occurs from the inside – out. Kegan emphasizes the priority of the self to develop from exterior stimuli. This influence is important to the conversation about change because Kegan's emphasizes that advanced cognitive processes lead to particular considerations of the self's relationship to context. At the core of how cognitive change is shaped by social influences lies the notion of how

the self clings to old cognitive schemata versus how it assimilates new stimulus. Kegan focuses on this conflict and uses it to shape his theory.

Piagetian influence. Central to Piaget's framing of development is the idea that the mind organizes experience into schemata. These schemes are results of the child's interaction with direct environmental encounters. This process is termed "adaptation;" the mind forms experiences into organized frames. Piaget (1932) also uses the two terms, assimilation and accommodation when discussing particular moments of growth. Through this continual process of adaptation, the child evolves by interpreting her environment and building new organizational structures internally (Berk, 2004). Kegan communicates these reorganizations through the metaphor of subject/object relations. Foundationally, this language is born out of Object Relations Theory as established by Margaret Mahler (1983). Specifically, she regarded "objects" as mental images of key individuals from a person's life formed in the mind. As an infant grows, it processes through levels of attachment based on these objects. It is significant that she communicates this concept through the use of attachment in terms of relationship. Objects, in this sense, are formed by images and behaviors of key individuals in the child's life. Similarly, we hear overtones of Kegan's model as Laura Berk describes a transition between two stages in Piaget's model, "Whereas concrete operational children can "operate on reality," formal operational adolescents can "operate on operations"" (Berk, 2004, p. 363). This phraseology is repeated when Kegan describes the transitions between "orders of consciousness," his terminology for developmental levels. He talks about moving from subject to object, wherein the subject is able to differentiate, or move from embeddedness as a subject – "this is me" – to a new subject that is larger than the

self but encompasses it. In a similar way that Piaget (1932) describes "operating on operations," the new subject is able to objectify the previous subject – the self "owns" its former self. Development happens as individuals reform their relationships with the "objects" in their lives and become able to detach from them as they advance. Significantly though, there is a degree of "stuckness" as Kegan's use of the term, "embeddedness" suggests. Attachments to objects may hinder the developmental process.

Kegan reports that Piaget's theory describes cognitive development as an act of continual interaction between the self and the environment:

> "In fact, Piaget's vision derives from a model of open-systems evolutionary biology. Rather than locating the life force in the closed individual or the environmental press, it locates a prior context which continually elaborates the distinction between the individual and the environment in the first place. …Its primary attention…is not to shifts and changes in an internal equilibrium, but to equilibrium in the world, between the progressively individuated self and the bigger life field..." (Kegan, 1982, p. 43)

This description captures a significant interpretation by Kegan, a nuance in Piagetian development theory. The subject, as a continually evolving entity, is influenced both by its internal and external context, which advances his application of the theory. This framing initiates conversation about the complicated relationship between the self and contextual factors. Developmental theorists rise and fall based on their conceptualization of this relationship, and the same is true for this study. Through emphasizing Piaget's (1932) grasp of the continual evolving of self and environment, Kegan walks the fence

between the two, giving some flexibility to his construct, but also opening the door for discussion about how development operates between conceptions of the self and its larger surroundings.

The predecessors of Kegan's constructive-developmental approach provide an outline of his general philosophy. Cognition and the establishment of "the self" are not formed through an internal mechanism or hidden id/ego with an agenda, but subjectivity is gained contextually and is in constant motion. Differentiation happens, but it happens within a contextual framework. In other words, development is a continual process of construction in motion, of borrowing from the external and adding it to an internal context which becomes a new context for the next process.

Change in cognitive developmental theory. While the process is not directly linear, scholars tend to agree that there is gradual cognitive advancement, or development, over time. Using Kegan's language, the "subjects" that are created become increasingly complex and relativistic. While there is not a clear delineation of what exactly happens, the mechanism of change in cognitive development centers on dissonance, assimilation, and accommodation. As a student interacts with specific environmental dissonance, the mind creates a more complex network to deal with this stimulus. Theoretically, multiple reorganizations lead to advanced cognition. However, there is also clear evidence of developmental setbacks or lack of change. When the mind reacts to incongruent information toward a more simplistic organization, it reverses developmental trends.

The term egocentrism has been used to describe cognitive inflexibility. When defined as a "failure to distinguish the symbolic viewpoints of others from one's own"

(Berk, 2004, p. 217), it can be said that egocentrism is akin to failing to recognize differentiation. In this sense, despite a confrontation with new environmental stimuli, the subject continues to retain previous organizational schemata. Fred Danner (1981) describes egocentrism as a state in which a person acquires a new mental skill or reaches a new understanding of their own development and feels empowered to apply that skill or sense of growth to multiple new situations. As that process matures, people become "embedded in their own point of view." The new skill, way of thinking, or point of view eventually becomes obsolete and egocentric application lessens. Egocentrism has both positive and negative effects; we are both excited by new ways of thinking and eventually become embedded in them. This perspective centering can also be equated with subjectivity. The self becomes the center of perspective, the primary subject inside a worldview. As intellectual skill loses novelty, perspective becomes less significant and more scrutinized, thus more objective. Acting with more objectivity opens a person up to the possibility of acquiring a new intellectual skill as the mind searches for a novel approach, thus repeating the process.

Most students enter college at a developmental stage close to Kegan's Second Order Consciousness, which is characterized by the mind's creation of "durable categories" – lasting classifications of physical objects, people, and desires which come to have properties of their own that characterize them as distinct from "me." (Love & Guthrie, 1999). The nature of the second order to formulate differentiation makes the categories separable and distinct. The mind creates clear boundaries between categories. The durable nature of the categories, in effect, makes them incomparable. Shifting into the third order of consciousness, that of multiplicity, in which one begins to grasp the

relationships between categories, is counter-intuitive to the second order's separateness. Assimilating and then accommodating this difference generally takes multiple reorganizations.

The language of change in cognitive development study focuses on the mind's incorporation of environmental dissonance. Change between the Second and Third Order of Consciousness (as defined by Kegan, 1982) happens slowly as resistance caused by egocentrism and the strong nature of the mind's organization is overcome and new schemata are formed.

Epistemological Developmental Theory

William Perry (1970) was the pioneer of epistemological development theory as applied to college students. His findings and analytical method presented a coherent model of beliefs formation. This study examined the nature of students' thoughts about knowledge, their conceptions of truth, and the way they felt those beliefs compared to others in college at Harvard. Berk describes how he characterized the way

> "Younger students regarded knowledge as made up of separate units whose truth could be determined by comparing them to abstract standards – standards that exist apart from the thinking person and his or her situation. As a result, they engaged in dualistic thinking, dividing information, values and authority into right and wrong, good and bad, we and they." She goes on to explain Perry's findings that "older students …moved toward relativistic thinking… [and] consequently, they gave up the possibility of absolute truth in favor of multiple truths, each relative to its context" (2004, p. 432).

This basic premise has been the center of evaluating the epistemological beliefs of college students. While Perry had the intention of understanding the way students at Harvard were facing a changing culture, his primary contribution was a stage-like model of development and a scheme that outlines the tendencies of growth. Of most significance, perhaps, is his finding that most college students struggle with moving from dualistic to multiple perspectives and this conflict forms the background for change. This is consistent with Kegan's constructive-developmental model. Perry's work does fit into cognitive development frameworks, but is more specifically directed at perspectives about knowledge. His research represents a seminal work in the field of epistemology.

In 1990, Marlene Schommer presented a theory of epistemological beliefs with five constructs, three that described the nature of knowledge and two that dealt with knowledge acquisition. Her Epistemological Questionnaire (EQ) hypothesized a five epistemic beliefs construct: (a) Simple Knowledge (b) Omniscient Authority (c) Certain Knowledge (d) Innate Ability (e) Quick Learning. This designation "represented a significant shift in epistemological research" (Wheeler, 2007, p. 20) because her dimensions were more independent than the broad structures of previous conceptions of epistemology.

The Simple Knowledge construct described the way in which understandings moved from seeing knowledge as small, separate particles to concepts that meshed together (Schommer, 1990). Certainty of Knowledge expressed a similar developmental pattern of movement – from absolute to tentative – as Perry's scheme. Omniscient Authority refers to the continuum starting with the less-developed conception that knowledge can only be acquired from an authority to the more-developed notion that

learning is interactive and to be self-discovered. Significant to this study, "this is the only hypothesized dimension that has failed to emerge in factor analytic studies of Schommer's Epistemological Questionnaire" (Schommer, 1990; Schraw et al., 2002; Wood & Kardash, 2002) (Wheeler 2007, p. 21). These findings refuted Schommer's original hypothesis that Omniscient Authority is a valid construct of epistemological beliefs. As a result, this study hypothesizes authority as a factor of social influences rather than a source of knowledge as it was originally conceived.

Schommer named the fourth construct Innate Ability. Similarly to the other constructs, a more naïve point of view saw intelligence as an inherited ability and less like a skill that could be developed. The second knowledge acquisition attribute, and the fifth epistemological belief construct was Quick Learning. In the more advanced view, knowledge could be attained with continued effort and persistence and conversely, the underdeveloped view saw learning as happening rapidly or not at all.

Following in Schommer's footsteps, Barbara Hofer (2000) proposed a similar theory of epistemological beliefs and created a survey to verify her hypotheses. After factor analyzing her results, Hofer claimed that two categories formed personal epistemology: the nature of knowledge – what one believes knowledge is; and the nature or process of knowing – how one comes to know. These two continua validated Schommer's conception of epistemology and simultaneously streamlined it by eliminating the impact of conceptions of authority, truth, and other socially driven concepts.

Hofer also attempted to differentiate developmental models from independent beliefs about knowledge. Essentially, she viewed development as an interconnected system of webs made up of points of beliefs. This added the personal dimension of epistemological development to the construct. As people identify and justify their conceptions of knowledge, developmental growth occurs. However, these conceptions also seem to cluster around particular commonalities about sophisticated understandings of knowledge. As noted in other developmental schemes, beliefs about the structure of knowledge still move from simple to complex and justification for knowing moves from subjective to objective. This corresponds to Perry's analysis and Kegan's orders.

Epistemological change theory. While some solid contributions to the field have been made, scholars have yet to unilaterally confirm exactly what is happening as students change epistemic beliefs. Despite the progression of analysis since Perry's 1970 study, the majority of researchers still call for a more finite synopsis of change. Hofer claims, "Fewer suggestions about instructional implications come from those studying beliefs, perhaps because we know less about belief acquisition and belief change, an area that needs more attention in the epistemological realm" (2001, p. 375). As a result, the impact of epistemological analysis has been limited because of its failure to directly address how specific development occurs. Marcia Baxter Magolda (2004), who has contributed multiple studies to the field, suggested that more research "focused on the interplay between internal and external factors in developmental change" is needed because of the role authority and expertise play in shared knowledge (p. 41, 42). Insight into the way in which authority and social context prohibit and encourage growth is needed because of the relational aspect of the shift from formulaic responses toward more

objective ones. This study is an attempt to provide clarity about how development happens by exploring the epistemic beliefs of students and the way their social contexts influence change in those beliefs.

Some researchers, exemplified by David Long (2011) in particular, claim that general stage models give little consideration to the effects of context. As a result, leaders in educational settings, have difficulty applying the concepts of general epistemology (Hofer 2001). The detriment of a context-neutral approach is that little can be shared about how change happens in specific instances. As most recent data on epistemology is gained from interviews, context has been exposed as highly relevant and more consistently taken into consideration (Pizzolato et al., 2012). Theoretical conclusions can be drawn from individual contexts as they are commonly experienced, but these must be more clearly delineated and analyzed at the microscopic level. Loucas Louca, Andrew Elby, David Hammer, and Trisha Kagey addressed this conclusion when they suggested that "stage-based accounts fail to identify a mechanism for [the] occurrence of [within-subject variability]" and that "opening up the "black box" of a developmental stage and exploring the finer grained cognitive elements within" reveals profound insight (2004, p. 61). To date, their introduction of this concept has not been adequately verified. When they described beliefs as "the units—the cognitive "atoms"—of epistemologies," it resonated with demands in the literature for a more detailed, analytical approach to the nature of epistemological change (Louca et al., 2004).

Bendixen and Rule's (2004) epistemological change model synthesized several theories, but was not based on an actual study. Despite demand for research focused on epistemic change, their ideas were neither borrowed by other scholars, nor consistently

used as a framework for proving or disproving the elements involved in change. Key concepts in the "mechanism of change" model are "epistemic doubt, epistemic volition, and resolution strategies" (Bendixen & Rule, 2004, p. 69). The operative phrase for discontent in this theoretical framework is epistemic doubt. As people are confronted with discrepancies between their understandings about the source and complexity of knowledge, doubt occurs. "Dissonance is the more general feeling of disequilibrium and epistemic doubt is specifically questioning epistemological beliefs or weighing epistemological options" (Bendixen & Rule, 2004, p. 74). Describing dissonance as a more general phenomenon highlights subtle, but key differences between epistemological development and cognitive development. Epistemology is framed to more directly examine specific beliefs about knowledge – its certainty, significance, origin and justification (Pintrich, 2002), while cognitive development theories tend to focus on shifts or changes in broader schemata and deal with empirical dissonance. Using the term doubt to sort out how individual beliefs about knowledge have changed or grown in complexity may help researchers describe how both epistemological change occurs and cognitive advancement begins, but not completes, its schematic organization process. In examining this phenomenon, knowing how and why individual beliefs are doubted lends specificity to developmental processes. In the interest of measuring change, it is necessary to formulate a context of epistemological origin. Knowing how individuals prioritize informational authority and which processes of understanding they typically practice to formulate beliefs serve as a background for the entrance of doubt.

Volition is the second aspect of the mechanism of change. In order for people to move through perspective shifting about knowledge, a force of will is typically enacted.

Lee Corno (1993) defined volition as a "dynamic system of psychological control processes that protect concentration and directed effort in the face of personal and/or environmental distraction" (p. 16). When faced with the distraction of contrasts to belief, the mind reacts with processes that move toward resolution. Control and protection systems erupt in a manner that attempt to resolve doubt and discrepancies in experience. This is similar to the process of assimilation discussed in cognitive development theory. Baxter Magolda (2004) describes the process as individuals taking 'responsibility' for their epistemological beliefs. It must be pointed out that volition is not necessarily directed toward advancement, complexity or relativity. Recognizing the imprint of volition provides insight into which processes and information are being challenged, modified or evaded.

Resolution is the third step in Bendixen and Rule's mechanism of change model. The drive of volition moves the mind toward resolution. Volition is a more reactive process and cannot be indefinitely sustained; movement is merely initiated and resolution is a healthy outcome. However, before resolution can be a viable option, the perspective that has caused epistemic doubt needs to be tenable. Bendixen noted the influence of Dole and Sinatra (1998) and claimed, "A key element in the possibility for change is that new information must be comprehensible, coherent, plausible, and rhetorically compelling to a particular individual. Essentially, if this discernment results in evidence that seems credible, then more advanced beliefs can develop" (Bendixen, 2004, p. 72). There may be a direct correlation between the convincing nature of new information, experience or perspective and personal epistemological development. Alternatively, students sometimes do not progress no matter the profundity of the information.

Regression is a potential outcome of resolution. In these cases, it is quite possible that social factors override the plausibility of new ideas. This also validates the role reflection plays in the process, which is a process of understanding how an experience challenges previously held beliefs and influences the formation of new ones. Metacognitive ability may also help students move through this process more adeptly. Reflection is a predominantly objective process, requiring that the subject distance itself from what is being evaluated. While students within most stages of development could perform such a task, the quality of their analysis would increase at advanced levels. This again suggests that epistemological processes are situated within broader cognitive orders.

Jane Pizzolato has most recently added to the work of Baxter Magolda in further examining self-authorship, absolute knowing, transitional knowing, and the relationship of context to change. She separated internally and externally motivated decision-making catalysts and outlined different decision making purposes. She used all of these concepts to focus on change and in particular, the concept of the "provocative moment." Pizzolato describes this as "an experience that resulted from jarring disequilibrium" and "led to commitment to, rather than only recognition of the need to turn inward in a search for self-definition" (2005, p. 625). In a classical sense, she connects experiences of disequilibrium to moments of change. Furthermore, harkening to one of Perry's scheme stations, "commitment in relativism," she implies change has to do with commitments toward new behaviors. Pizzolato's work is significant because it begins the process of examining the change process by qualifying some moments over others as provocative. There is also evidence that these moments are individually differentiated over criteria like

volitional efficacy and behavior regulation. These characteristics are a beginning point for discussing the nature of change, particularly as it is immersed within student contexts.

Introduction to Social Influences

In this study, particular social influences have been identified to connect appropriate concepts of contextual change with the construct of personal epistemology. They are introduced here as elements in the change process and fit within Bendixen and Rule's (2004) model as a result of doubt and as an influencing factor shaping volition. Starting from the concept that context impacts change, generally, they are ontological, social forces that deter or promote growth. Students can become "stuck" in developmental processes, as noted by Kegan (1982) and clarified by the concept of egocentrism. However, the concept of social influences suggests that students are mired in a social milieu made up of authority, attachment, and affect rather than in a particular developmental stage or fixation of ego. These concepts do not refer to an ideological embeddedness, or a particular embedded concept. Rather, this study explores a configuration of social and contextual factors resulting in "clinginess" to epistemic beliefs. Insights from a theoretical framework emerging from how cognitive development and epistemological development address change deepen the analysis into the nature of relationships between context, beliefs about knowledge, and development.

The process of measurement in both cognitive and epistemological studies has also contributed to understandings of these social influence factors. Qualitative measures of cognitive development have informed the construct by evaluating and emphasizing particular social and affective elements. Quantitative measures, mostly through factor analysis, have revealed particular hypothesized dimensions which appear to "fall out," or

be determined as non-significant. These measures have clarified which aspects of elements should remain as part of the construct and which ones should be eliminated. The Social Influences Survey (SIS) has been created in response to these potential factors. The survey will be used alongside the Epistemological Beliefs Inventory (EBI, discussed below) to explore this relationship.

Quantitative Measures of Epistemology

Tracing the way in which devices that measure epistemic beliefs have evolved brings clarity to both the nature of the construct and the effectiveness of those tools. Omniscient Authority, in particular, has proven troublesome to measure and has been often been removed from research projects. The evolution of these quantitative measures has been recounted here both to present a clearer picture of the construct of epistemic beliefs and to establish that authority is more accurately theorized as an element of social context.

Marlene Schommer (1990) used the term epistemology to describe the developmental process Perry (1970) investigated. However, her research worked to examine the connection between epistemological beliefs and comprehension, which linked it to cognitive development. Her "conceptualization of personal epistemology as a multi-dimensional set of beliefs…initiated a methodological shift toward quantitative measurement of the construct." (Wheeler, 2007, p. 29). This conceptualization matches the later findings of researchers like Hammer and Elby and Hofer who suggested changes in beliefs could be measured more directly than general cognitive shifts. As a result, unlike other researchers in the field, Schommer wasn't convinced that interviews were the best way to measure epistemological level, so she developed and continually

operationalized a questionnaire. Her use of a combination survey and a comprehension test fit her specific research questions, but they also provided a model other researchers could use to apply to educational settings.

Schommer borrowed heavily from the measurement device created by Rand Spiro (Feltovich, Spiro, & Coulson, 1989) in forming her own questionnaire to examine the connection between comprehension and personal epistemology. Feltovich, Spiro, and Coulson's research established that medical students tend to apply simple learning processes to more complex problems when they receive simplistic and regimented instruction. Jehng, Johnson, and Anderson (1993) used Schommer's questionnaire and similarly discovered that students expressed different levels of complex or simplistic thinking across a variety of fields. This school of researchers investigated why some students showed growth in one area of study and not another. They began asking how complex relative thinking in one field could be applied to other disciplines. Their results also suggested that developmental studies could be compartmentalized to investigate cognitive processes in more detail. This area of research and its concepts has been termed domain specific epistemology.

Schommer's efforts to quantify beliefs serve as a foundation for resulting methodologies and are thus the starting point for modifying quantitative tools. Her Epistemology Questionnaire (EQ) was administered to 263 students, primarily freshmen and sophomores. The factor Omniscient Authority produced low loadings during factor analysis, but the other four constructs were confirmed. Schommer conducted a second study and used factor analysis to further attempt to validate her construct (Schommer, Crouse, & Rhodes, 1992). The results caused her to merge Innate Ability and Quick

Learning into one factor. A third analysis was conducted, this time with a sample of 1182 high school students (Schommer, 1993). This study essentially confirmed the four dimensions of the construct. A fourth survey was given to 418 working adults (Schommer 1998) that gave similar results. While Schommer's construct did not produce overwhelmingly significant results (the four factors accounted for 46% - 53% of the total variance in the four studies), it continued to be studied and built upon by other researchers.

Seeking to create a survey that examined domain specific epistemological beliefs in mathematics, which resulted in The Epistemological Beliefs Survey for Mathematics (EBSM), Wheeler (2007) presented a thorough analysis of measures that had been used to that date. Among others, these included the Revised Epistemological Belief Questionnaire (Qian & Alvermann, 1995), the Beliefs About Learning Questionnaire (Jehng et al., 1993) and two significant foreign language translations of the construct (Chan & Elliott, 2000; Clarebout, Elen, Luyten, & Bamps, 2001). Overall, her analysis suggests that continued refining of the process of measuring beliefs has proven difficult. Predominantly, there was some consistency, but most measures fell short of statistically acceptable levels. In the end, Wheeler used the Epistemological Beliefs Inventory (EBI) (Schraw et al., 2002) to validate the EBSM because it was the most often tested, and therefore most reliable starting point for investigating her construct.

Epistemic Beliefs Inventory. The Epistemic Beliefs Inventory was created to improve the reliability of the EQ and further analyze epistemological beliefs constructs. The researchers hypothesized that a shorter instrument might improve psychometric consistency. Both the EQ and EBI were administered to 161 students. "The EBI

generated five factors with eigenvalues greater than one, representing 60% of the total variance" (Wheeler, 2007, p. 50). This seemed to suggest that the EBI was a more reliable measure, but when the surveys were re-administered, the two results were compared and statistical analysis revealed, "it is unclear what these two instruments measure and the extent to which they measure the same or unrelated constructs" (Schraw et al., 2002, p. 273). Such results are discouraging, but continued testing implies that the construct is somewhat valid but needs fine-tuning. Welch and Ray (2013) analyzed further reproductions of the EBI and report that some factors consistently account for acceptable levels of variance. These revolve around four of Schommer's original constructs: Simple Knowledge, Certain Knowledge, Speed of Knowledge and Innate Ability, with some variations in terminology. However, "The factor identified by Schraw (1995) as Omniscient Authority (Q4, Q7, Q20, Q27, Q28) did not emerge from our analysis. Kardash and Wood (2000) were also unable to isolate Omniscient Authority…as a unique factor." (Welch and Ray, 2013, p. 295). Wheeler (2007) found the same to be true in her comparison of the EBSM to the EBI. The nature of the effect of authority on development remains ambiguous despite multiple attempts to include it as a dimension of epistemic beliefs.

Measuring epistemic beliefs to statistically valid levels has continued to evade researchers. The desire to understand the relationship between epistemic beliefs, classroom environments, developmental considerations, and the influence of teachers, parents and peers remains (Muis, 2004). In order to examine the confluence of these interconnected systems, an accurate measure of epistemic beliefs is needed (Wheeler, 2007). Despite the way in which a concrete consensus has eluded researchers, key advice

has emerged for future research. In particular, due diligence must be paid to generate a construct grounded in accurate theory. When this is present, the inadequacies of measures still allow for insight into the nature of the constructs in play. Furthermore, dimensions must be carefully chosen and firmly theoretically grounded to be reliable among multiple samples. This will also allow for explanatory rather than just descriptive results, which may produce a more accurate construct (DeBacker, Crowson, Beesley, Thoma, & Hestevold, 2008). The history of measurement has refined what epistemic belief elements should be included. While not with ideal results, measurements have concluded that Simple Knowledge, Certain Knowledge, and Innate Ability/Quick Learning have proven more to be stable indicators of epistemic beliefs. As such, a conclusion that Omniscient Authority may relate to epistemological beliefs in a different way is reasonable.

Ecological Developmental Theory

In seeking to earnestly provide theoretical clarity and debate, the Bioecological Model (Bronfenbrenner, 1994) is presented here as an alternative developmental theory. It exists as a broader developmental model that can be applied to a variety of processes of which cognition and epistemology are only two. The model helps establish social influences as a factor in development because it closely examines both the change process and the shaping nature of context in terms of development.

In a landmark study, Urie Bronfenbrenner conceptualized development (1979) and later considered it from a biological point of view. His model presented development as a result of multiple levels of systems operating interactively with an individual. This organic, dynamic systems structure suggested that different groupings of environments

had different effects during the developmental process at any given time (1999). His conception of context involved four interrelated systems – microsystem, mesosystem, exosystem, and macrosystem (listed from the inside out). He later identified the chronosystem, which added the dimension of time to the model. The microsystem and mesosystem and their processes most closely inform development as it relates to individual change and therefore will be more closely presented. The microsystem includes the person and all immediate environmental forces such as neighborhood, school, home, and workplace. Study and discussion around the microsystem involved patterns of activity, roles, and interpersonal experiences. These encapsulated places of immediate contact between the child and the environment. The mesosystem focused on the interconnected relationships between microsystems, "in short, it is a system of two or more microsystems" (Bronfenbrenner, 1999, p. 17). Most developmental models do mention that context impacts change, but the Bioecological Model more clearly establishes the way these environments interact. Both the makeup of mesosystems, the way in which individuals mesh their contexts interactively, as well as the influences of agents in the microsystem directly informs the construct of social influences used in this study.

Change in Ecological Development. Bronfenbrenner's later writings emphasized the significance of processes on human development. He described the Process-Person-Context-Time model (PPCT), which has become the essence of his theory. Proximal processes, those involving more immediacy between the individual and her environment, were the most influential in development. (Tudge, Mokrova, Hatfield, & Karnik, 2009). Bronfenbrenner noted that these interactions were more effective when

they "occur on a fairly regular basis over extended periods of time" (Bronfenbrenner & Morris, 1998, p. 996). The impact of proximal processes is shaped by "form, power, content, and direction" as well as the characteristics of the developing person. Based on the evidence of a study on parenting, he noted that higher levels of interaction tended to trump environmental effects. In other words, the more consistent the process and the more intimate the relationship, the greater its impact on development.

"Person" in the model refers to characteristics of the developing person. He further compartmentalized these into demand, resource, and force characteristics to clarify their operation in the process. These include but are not limited to age, gender, housing, parents, temperament, and motivation.

"Context" refers to any of the systems – micro, meso, exo, macro – previously described.

Bronfenbrenner broke down the influence of "Time" (the chronosystem) into similar micro, meso, and macro forms. Of importance is the duration, consistency and timing of proximal processes.

In the Bioecological Model, developmental change happens through proximal processes that are "progressively more complex reciprocal interactions." These vary systematically as a joint function of the characteristics of the developing person, of the environment – both immediate and remote – in which the processes are taking place, and the nature of the developmental outcomes under consideration (Bronfenbrenner, 1994).

Operationalizing Social Influences

The literature shows that there are contextual forces at play in the shaping of cognitive and epistemological development. The change process is intricately affected by

social and environmental factors. Breaking down the nature of change into smaller processes and in particular moments reveals that dispositions toward knowledge hold students in naïve stages or promotes them toward more advanced stages. "Rozendaal, de Brabander, & Minnaert (2001) emphasize that knowledge construction does not take place in a vacuum, but in a social process of discussion" (Bromme, Kienhues, & Stahl, 2008, p. 437). As a result, unpacking the way social influences shape the formation of epistemic beliefs is core to the study. Bronfenbrenner brings clarity to the nature of these influences by suggesting they are socially constructed through continual interactive processes. These most often occur in the microsystem and through the mesosystem. Pizzolato, Nguyen, Johnston, and Wang (2012) confirmed this by claiming development "may be more interpersonal than autonomous, as it has been previously documented" (p. 673). Understanding the way the psychological contexts of family and peers impact moments of doubt is central to evaluating epistemological change. The nature of social influences will be clarified in this study to give more meaningful significance to the results of the research.

Heidegger describes how the developing person is "born into a world with cultural equipment – a heritage of traditions embodied in situated understandings" (Heidegger 1962 [1927]) (Long 2011, p. 90). Development is shaped, therefore, by the traditions of family, the processes of interaction, and the psychological pull of microsystem level forces. Exposing the nature of these relationships and grasping the way they affect epistemic belief change leads to a greater understanding of how social influences are being framed for the present exploratory study. While there may be future efforts that examine multiple other factors, those presented here are supported by the

literature and previous studies. The resulting relevant social influence constructs to be explored include epistemological authority, awareness of interpersonal attachment, and pressure imposed by a fear of loss.

Authority. Omniscient Authority was one of the original constructs hypothesized by Schommer. In its conception, it was defined as an aspect of the Source of Knowledge. It was also emphasized by Perry. These perspectives suggested authority permitted the knower to avoid responsibility for making judgments about particular knowledge claims (Braten, Britt, Stromso, & Rouet, 2011). Theoretically, a point of view would be considered more valid if it came from a person or other representation of authority. Students would not have to think responsibly, engage with the idea, or make a judgment about it if they held a naïve perspective, essentially trusting that the authority was "right." More advanced students may engage multiple perspectives from different sources of authority and make more complex judgments. As an epistemological construct, authority was examined as a source of knowledge rather than one with relational implications. Authority was measured in terms of "correctness" regardless of the relationship to the knower. It was continually found as unreliable in factor studies, but it has been included in this study with the original EBI survey for the sake of historical consistency. However, additional questions about authority in the SIS have been crafted in response to the hypothesis that authority may carry a relational factor in addition to a developmental one. Determining the ways in which these two concepts of authority intermingle and separate may provide significant contributions to the study of epistemic beliefs.

For this study, authority has been reconceived as a factor of social influence. This may not only help clarify the nature of the force of authority on development, but add to

the clarity of the Omniscient Authority construct of epistemic beliefs. As an embodied person, authority establishes preconceived notions about knowledge through social influence. Authority may also be a manifestation of "historical contingency and social power." In these cases, "Truth is, for such people, timeless and immutable. To question this type of Truth meaningfully is to shake off the spell that such Truth holds over its believers" (Long, 2011, p. 58). Conceptually, the developing person reacts to doubt by relying on an authority, be it a person or social norm, and therefore fails, in that instance, to develop. To be clear, this would be established according to the person's dependence on the source rather than the plausibility of the concept at hand. Previous conceptions of epistemology saw this factor as a dimension on the developmental pathway – as a naïve or complex evaluation of the source of knowledge. Reconstructed here, authority is a contextual influence that prohibits or promotes change. The strongest authorities are the ones most closely aligned with the learner and are often engaged with them in proximal processes. Long (2011) also describes how exclusivist thinking from a person's past or upbringing can mute inquiry, which inhibits epistemological reflexivity. Pizzolato and her co-authors note that these kinds of authorities are often familial or cultural (Pizzolato et al., 2012). As a construct of social influence, the power of epistemological authority permits the student to disengage from doubt, relying on authoritative others with whom they consistently interact.

Naïveté of attachment. The second social influences factor to be explored regards the level of understanding a student has of the nature of their personal attachments. Described in terms of the Bioecological Model, a developing person could operate with a generally closed, but active microsystem. A student in this situation may

have more simplistic proximal processes interacting with dissonance or doubt. When doubt does surface, the student has influential relationships to consider and may evaluate how changing her perspective may impact those relationships. However, it is not the significance of these relationships and how habitually they inform epistemic decision-making that deters or promotes developmental growth, but rather the student's awareness of them. This research attempts to measure the student's naïveté regarding the strength of their social attachments as they apply to epistemic beliefs. Pizzolato and her colleagues present an alternative self-authorship model, the Interactional Model of Self-Authorship, which considers the interplay of these psychological contextual factors. They claim that, "what seems to develop is not a system of self-authorship, but an ability to manage an existing system" (Pizzolato et al., 2012, p. 674). They also suggest that different psychological fields exert different levels of pressure on the cognitive system. This model would assess cognitive developmental level according to how aware a student is of the competing factors within the system they are managing. Bronfenbrenner notes that proximal processes have varying effects based on multiple factors, one of which is the constitution of the family, particularly parental contributions. A student with a more closely-knit social circle will experience a different developmental pattern. This is not to suggest that a student who emphasizes these relationships is "overdependent (and therefore less developed), but… [expresses] a way in which the student fuses multiple contexts of his or her life" (Pizzolato et al., 2012, p. 676). Posited differently, a student who knows and acknowledges the ways in which her relationships influence her decisions about beliefs and information and how she manages these inputs is more significant to change than the nature of the relationships themselves. Merging the

theories presented by the Bioecological Model and the Interactional Model of Self-Authorship leads to the understanding that intimate relationships are likely the highest influencer of development, "but self-authorship occurs when there is a higher level of awareness of these systems and a person is able to manage the already existing systems" (Pizzolato et al., 2012, p. 675). Those who more accurately understand how their closely tied relationships are involved in establishing epistemological beliefs develop more readily. Naïveté of attachment is therefore concerned with how cognizant students are of their contexts rather than whether or not those contexts are more or less developed. As a result, the goal is to measure how much a student grasps the influence of those ties. Long describes that students who attempted to grow beyond the constraints of these relationships "risked disenfranchisement" from their family and social groups. The intimacy of those relationships from an epistemological standpoint does impact their belief systems; however, the risk they may feel is more related to a third aspect of social influences.

Fear of potential loss. Implicitly, David Long (2011) identified a key aspect for this study while he explored student dispositions concerning epistemic beliefs about science. As students emerge from First Order Consciousness, they inherit much of their understanding about knowledge from their environment, and as Bronfenbrenner points out, these are mainly composed by those within the microsystem (1994). The kinds of environmental doubt children are likely to face are limited. As a result, students enter "provocative moments" with limited understandings about knowledge. Long describes these as ontologies, or worldviews. His discussions with some students revealed strong emotional attachment to their worldview, regardless of the composition of their beliefs.

As he further examined the way they wrestled with doubt, he expressed that they fear losing cultural meaning and social connectedness. For many of these students, epistemic change was equated with serious emotional loss. Grasping the nature of this kind of loss reveals some reasons why students progress or regress when they are faced with doubt. Long compared the way in which some students emerged to new understandings to jumping off an existential cliff:

> "Reframing one's ontological stance, or having it reframed for you, has definite social costs. Now, as we will explore later, it may also have benefits, but when standing at this brink, one only sees the possibility of destruction from a fall or the possibility of self-annihilation by throwing one's self off into the abyss" (Long 2011, p. 42).

Not only is shifting ones epistemology a matter of wrestling with doubt, it also is significantly impacted by emotion.

Contrastingly, as noted above, Bendixen (2002) argues (via Dole and Sinatra, 1998) that plausibility is an element of doubt and that clear coherent evidence may be a force in epistemological development, claiming that it cements doubt in the student's mind. She also suggests that doubt involves weighing evidence and discerning truthfulness. While this in part may be a developmental concern, the emotional factors involved, particularly for students who are deeply entrenched in absolutist cultures and ways of life has been less explored. Haviland and Kramer (1991) confirm that emotional spikes usually accompany growth (Bendixen & Rule, 2004). These can also lead to regression. While the outcomes are unpredictable, epistemological changes are typically preceded by emotional experiences. While results vary individually, students with

absolutist ontologies exhibited in microsystem level relationships could be predicted to have more difficulty advancing epistemic beliefs.

Querying students about the repercussions of changing beliefs could lead to a clearer understanding of a potential obstacle to epistemological development. Jennifer Berger (2010) echoes Kegan in describing the costs involved in moving into new cognitive understandings, suggesting that "a new way of seeing the world means first giving up your old way of seeing the world, understanding that what used to feel full and fulfilling now feels partial and lacking" (p. 17). Conceptually, students with strong feelings toward their beliefs will experience anxiety with the prospect of change. Interviews and personal conversations can unveil some of this, however, these findings tend to be subjective in nature and reveal less about trends experienced by students who are in similar situations. While the nuances of these connections would be difficult at best to determine through a survey, general forms of affect can be measured. Students in their first years of college likely experience similar emotional struggles as it pertains to epistemology. This third factor, fear of potential loss, seeks to evaluate the relative connectedness a student feels to their social environment as measured by a perceived fear of sacrificing it when facing change.

Summary

The effect of epistemic beliefs on education continues to be an often studied concept, but according to previous studies and analysis, more clarity is needed. More accurately understanding the nature of how epistemic beliefs affect learning can contribute to a number of applications that may improve educational practices. However, the construct of epistemic beliefs continues to produce unreliable measurement results.

Modifying current conceptions of epistemology led to a refining of the construct. The current study hopes to add to that practice by examining three social influences factors: authority, fear of potential loss and naiveté of attachment. This study employs these particular factors to more closely examine contextual influences on epistemological change. The results of a self-report survey of college students will be used to conduct a factor analysis to determine the fit of these constructs and instrument questions. They will also be compared to the EBI to determine if stronger or weaker social influences are related to mature or naïve epistemic beliefs. This analysis will produce a clearer understanding of how social, contextual factors are associated with epistemic beliefs, suggest modifications to measurement devices, and lead to recommend suggestions for future study. These can then lead to potential applications for educational practice.

Chapter 3

Methodology

The purpose of this chapter is to detail practical aspects of the research methods used in the current study. This includes the nature of the participants, demographic considerations, elements of other studies that have been referenced, data collection procedures, and statistical analyses performed. The central piece of the study is a self-report survey designed to reveal predicted subscales to represent epistemic beliefs and social influences. These subscales were then tested for significant relationships to each other. The survey also allowed for the collection of demographic information to be used as control variables, which permitted a more thorough analysis of the constructs involved.

Procedures

A pilot test was conducted to check the diction of the questions and to ensure the questions yielded appropriate responses. The sample was tested in September, 2014 with 23 participants. The survey was accessed through Qualtrics and made available during October of 2014. The university Internal Research Board application was filed and approved during the summer of 2014. Participants under the age of 18 and over the age of 25 were automatically prohibited. Contact information for students was sought and approved through university offices. Students were emailed a link to the survey. The email and introduction of the survey contained a brief explanation of the purpose of the study and instructions for completion and also contained a statement about waiver of consent as suggested by the IRB. All scales, excluding demographic descriptives, were measured using a six-point Likert type scale ranging from 1 (*very strongly disagree)* to 6 (*very strongly agree).* This scale is consistent with the Epistemological Beliefs Survey

for Mathematics (Wheeler, 2007), which was also a project created, in part, to explore methods of measuring epistemic beliefs. Qualtrics automatically compiled responses and stored them as well as served as a vehicle to send email introductions. A final section of the measurement device included an opportunity to submit contact information in the event that the study could be used for both longitudinal and qualitative evaluation in the future. Otherwise, participants were assured their anonymity. The survey is presented in Appendices A-C.

Participants

The sample includes students at a mid-sized Southeastern university. Ages were limited to range from 18 to 25 with the goal of reaching primarily freshmen and sophomores. Attempts were made to include students who are representative of the university population. If initial broad-based email results failed to reach this goal, additional students would have been accessed through the Office of Institutional Diversity, but this proved unnecessary.

The total university population of freshmen and sophomores, based on 2012-2013 data, is 10,050 (http://www.uky.edu/IRPE/students/enrollment/all-by-class.html). The desired minimum sample of 370, based on a confidence level of 95%, was achieved. After accommodating for missing data as noted below, an adequate sample size was achieved for the factor analyses and regression analyses as well. Some demographic tests had smaller samples because of incomplete data as noted. Demographic totals for the final sample utilized for all subsequent analyses are presented in Table 4.1 – 4.3. This sample size compares favorably with other tests in the field.

Instruments

The tool used to measure constructs of epistemological beliefs, the Epistemic Beliefs Inventory, was borrowed from the literature. The Social Influences Survey was generated in response to careful analysis of the epistemological change process and ways the process is impacted by social context. The theoretical basis for questions used in the survey is presented in the literature review, including reasoning for the hypothesized factors.

Demographic information. The survey starts with demographic questions that include age, college class status, geographic background, parents' education level, gender, racial identification, and field of study (see Appendix B). The final question in the demographic section asked about home environments and friend groups in the hope of identifying the homogeneity of social circles, which may be related to social influence constructs. Responses to this question were removed from analysis because the initial test sample produced erratic results, most often exemplified by incomplete answers. Based on observed responses, this was likely because Qualtrics presented it with a drag-bar, which secluded much of the question. The question may be used for future analysis if presented in a different manner.

Epistemic Beliefs Inventory. The Epistemic Beliefs Inventory (EBI) (Schraw et al., 2002) was created with the hope of validating the Epistemology Questionnaire (Schommer, 1990). Its original form consists of 28 items measuring five dimensions of general epistemic beliefs. The five hypothesized factors are Omniscient Authority, Certain Knowledge, Simple Knowledge, Innate Ability, and Quick Learning (Wheeler, 2007). As noted in the literature review, several resulting studies attempted to validate the

EBI, but because results proved difficult to replicate, modifications have been suggested. While creating the Epistemological Beliefs Survey for Mathematics, Wheeler reported coefficient alpha reliability estimates for a validation sample of 160 undergraduate university students ranged from 0.58 to 0.68 and noted that although these reliability estimates are less than optimal, they are typical of reliability estimates reported in psychometric studies of general epistemological beliefs. Despite the trouble associated with the EBI, it remains the most psychometrically sound measure of general epistemic beliefs currently available. It has also been tested multiple times and is therefore the most refined test to date. The purpose of including it in the current study is to assess the relationship between epistemic beliefs and social influences. Rather than create a new measure of epistemic beliefs, the EBI has been included in its original form to maintain consistency with previous research (see Appendix C).

Social Influences Survey. The social influences questions of the survey (SIS) were created specifically for this study. The goal of these questions is to measure a construct of social influences associated with epistemic change. Theory noted in the literature suggests that growth toward complexity in beliefs may be hindered or promoted by dispositions toward beliefs shaped within social circles. It is predicted that the three elements of Authority, Naiveté of Attachment, and Fear of Potential Loss will form the social influences construct. The measure includes sixteen items (see Appendix D).

Analysis

Data screening. Data was screened to remove incomplete survey responses. These were checked to see if they could be retained if they were missing totally at random according to Little's MCAR test (1988). To determine outliers and normality,

sum totals of all the responses for each item and their means were recorded for each of the EBI and SIS sections of the survey. Histograms for each mean were examined for normality and kurtosis. Outliers were removed using The Outlier Labeling Rule (Hoaglin, & Iglewicz, 1987). Pearson correlations were checked for evidence of multicolinearity. Responses to questions: EBI1, EBI3-EBI5, EBI7-EBI18, EBI20, EBI21, EBI23, EBI24, EBI25, EBI26, EBI27, SIS14 were reverse coded. Demographic questions D1, D3 - D9 were dummy coded in order to analyze them statistically.

Factor analyses. A Confirmatory Factor Analysis was performed on the results from the EBI to explore the five latent factors suggested by Schommer. Values for the Tucker Lewis Index, the Comparative Fit Index, and the Root Mean Squared Error of Approximation (RMSEA) were used to examine model fit. Because it is a newly created survey, the SIS was analyzed with an Exploratory Factor Analysis.

Stepwise multiple regression. Upon reaching plausible factor models for each of the EBI and SIS, subscales were introduced to suggest possible elements composing epistemic belief development and social influences. For each new epistemic belief factor, a stepwise regression was run to determine significant relationships between each and the social influences factors, resulting from the EFA.

Hierarchical multiple regression. Finally, a hierarchical regression was performed to test the predictive value of SIS subscales on EBI subscales after controlling for demographic variables. Each hierarchical regression, one for each epistemological beliefs subscale, was performed to evaluate the following hypothesis: It is predicted that the social influences factor subscale scores will be significantly negatively associated with the epistemology subscale scores after controlling for demographic variables. This

is surmised as a result of theories suggested in the literature review which imply that the social modifiers of Authority, Naiveté of Attachment, and Fear of Potential Loss can hinder epistemological development.

Chapter 4

Results

The results for each test performed as suggested in the project's Methodology are reported here and are organized according to the research question, "To what extent does a measure of authority, naïveté of attachment, and fear of loss as a result of change amongst college students help predict their level of epistemological development?" The response to the question centers around quantitatively exploring constructs for both social influences and epistemic beliefs. These were identified using factor analyses, thus reported first. Once the factors were determined, relationships between factors were examined by creating subscales for each. This was then followed by comparative stepwise multiple regression. Finally, with all of these results in view, a hierarchical multiple regression was performed and reported in an attempt to show the overall relationships between social influences and epistemic beliefs while controlling for demographic variables.

Data screening

There were 440 responses to the survey. Several responses to the surveys contained large amounts of missing items. These 59 incomplete surveys were removed. Also, because the hypothesized constructs are associated with a small number of items, responses with more than two answers missing were removed, leaving 333 complete responses and 37 with only one answer missing. Little's MCAR test (1988) was completed to determine if the 37 cases containing 1 missing value each could be retained. The results (Chi square=966.069, sig=.991) supported that the data were completely missing at random and therefore, the Expectation Maximization Algorithm (Dempster,

Laird, & Rubin, 1977) could be used to impute values for missing data. These data were imputed to retain the maximum sample size and 370 cases were used for each of the project's tests. The Outlier Labeling Rule (Hoaglin & Iglewicz, 1987) was used to determine outliers and no cases beyond the calculated upper and lower bounds were revealed. The histograms of the EBI and SIS item means showed that they were approximately normal distributions. Using a value calculated with the standard deviation of each produced no evidence of significant kurtosis. The results were checked for multicolinearity. Upon examining the Pearson correlations between these calculated means, no values above .521 were reported, so no issues with multicolinearity were found. Exploratory regressions performed to find VIF values also resulted in values within the normal range.

Demographic results of the sample

Responses to the demographic questions are recorded in Tables 4.1 – 4.3. Within the responses to the question about race, the "American Indian/Native Alaskan" and "European" options only received one response each. The responses for "other" and "I prefer not to answer" also contained small sample sizes, so they were removed from analysis. The racial breakdown of respondents resulted in some small group sizes, but these compare reasonably to the student population of the university. Under majors, only two students chose the "Technical" option, so those responses were removed from the analysis.

The Gender variable contained four optional responses, but only two students chose "Other" and two chose "Transgender". Because of these small numbers, the Gender variable was reduced to two categories (Male and Female) for the analysis.

Table 4.1

Group Totals by Demographic

College Class	Freshman: 223	Soph: 124	Junior:23	
Urban/Rural/Suburban	Urban: 93	Rural: 114	Suburban: 163	
Gender	Male: 97	Female: 267	Trans: 2	Other: 2
International	6			
Multiracial	30			

Table 4.2

Responses by Race

African American/Black	19
American Indian or Alaskan Native	1
Asian	11
Asian American	5
European	1
White/Caucasian	307
Latino/Hispanic	15
Other	6
I prefer not to answer	5

Table 4.3

Responses by Major

Biological Science	35
Business	36
Education	29
Engineering	57
Physical Science	14
Professional	70
Social Science	40
Technical	2
Other	86

EBI Confirmatory Factor Analysis

Because the EBI was used in its historic form and is backed by consistent theory, a Confirmatory Factor Analysis was employed to determine model fit for the data. The following figure shows the predicted linking of the items with the theorized constructs. The EBI items can be found written out in the survey (Appendix C). Figure 4.1, on the following page, represents the proposed CFA factor structure.

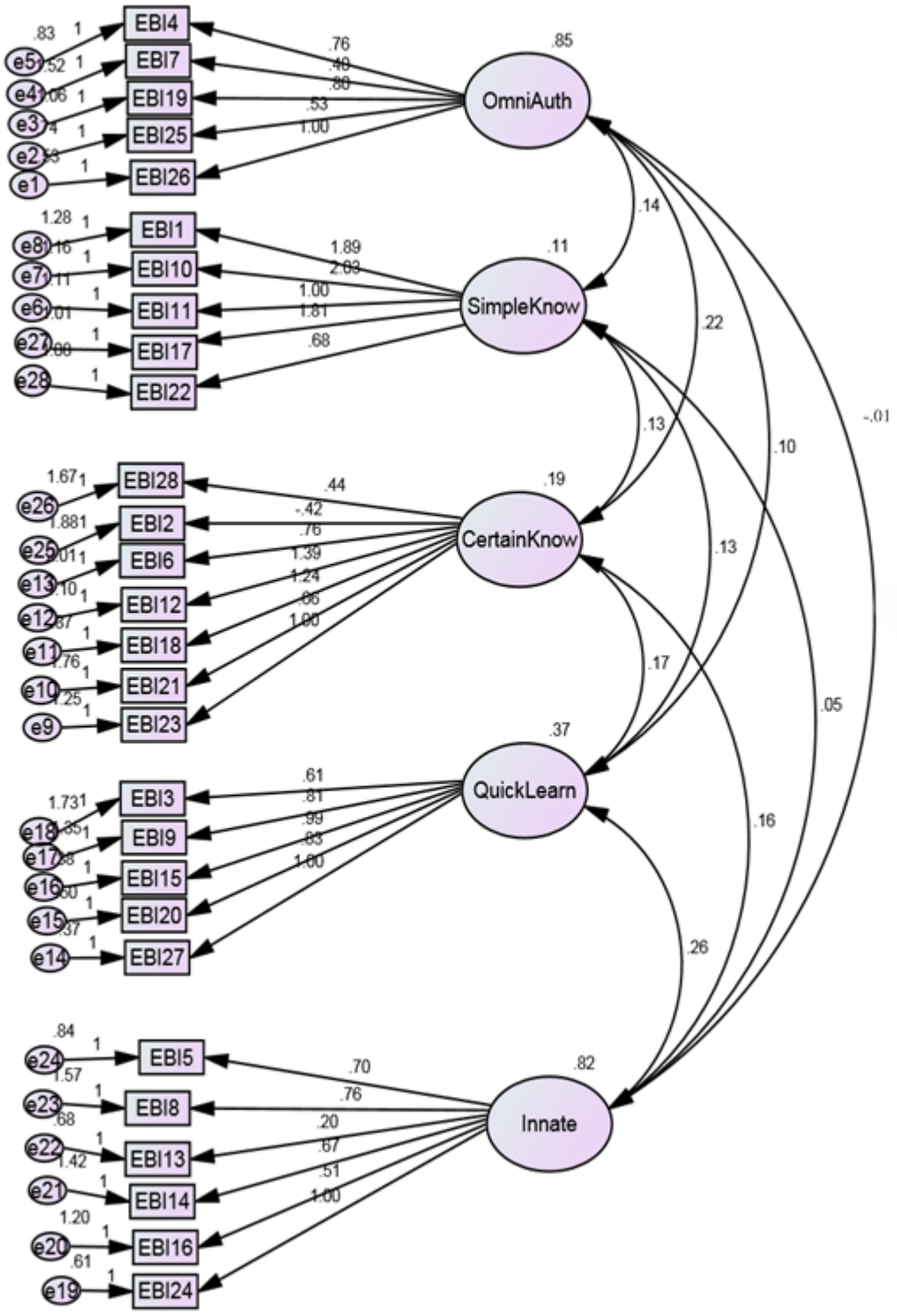

Figure 4.1. Confirmatory Factor Analysis diagram of hypothesized factors and corresponding items from the Epistemic Beliefs Inventory

The CFA for the hypothesized EBI constructs produced a poor fit using the CFI (0.66) and TLI (0.62) measures. Generally speaking, values of the CFI and TLI approaching 1.00 indicate better model fit (Hu & Bentler, 1999). The RMSEA measured 0.08, which indicates moderate to poor model fit because values below 0.05 generally indicate close model fit (Hu & Bentler, 1999). Therefore, four error terms on the same factor showing high covariances (suggested by using the potential chi-square reduction bound of 10.00) were coupled and the model recalculated. This produced similar, but only slightly improved results: CFI (0.71), TLI (0.67), RMSEA (0.07).

The absolute values of standardized regression weights range from 0.16 to 0.85. These values indicate the 28 measurement items represent their latent constructs by a wide range of strength. Generally, standardized regression weights approaching 1.00 suggest a closer tie between construct and item. These results indicate the model captures many weak relationships between items and constructs because most of the items had loadings less than 0.50 on their presumed latent factor. These low loadings and the above model fit results indicate a generally poor model fit, suggesting that an Exploratory Factor Analysis for the EBI section of the survey was in order.

Despite poor fit with the CFA, an ensuing EFA could reveal latent constructs for epistemic beliefs. Similar studies of the EBI have also resulted in poor model fit and low loadings on factors (Welch & Ray 2013). This study was continued with the hope of exposing relationships between constructs as driven by the data of this particular sample. Further analysis was directed at matching the data with potential latent constructs without imposing any preconceived structure on the outcome (Child, 1990) with the vision to promote accurate changes to the measurement device, as has been previously suggested

by these similar studies of the EBI. The primary objective of the continued study was to examine the relationships among constructs between epistemology and social influences as driven by this particular data set. Since the CFA statistics generally showed poor model fit for this sample, additional objectives for this study became refining the measurement process and implying direction for future studies. The resulting analyses are tailored for that purpose.

Exploratory Factor Analyses

EFA for the Epistemic Beliefs Inventory. A Principal Component Analysis with Varimax rotation was used to explore the latent constructs of the EBI with the current sample. This choice was made to emphasize the patterns emerging from the data in light of the poor model fit generated by the CFA (Brown, 2009). Using the literature review as a guiding framework, a five factor structure was explored first. This was also consistent with the scree plot (Figure 4.2, below):

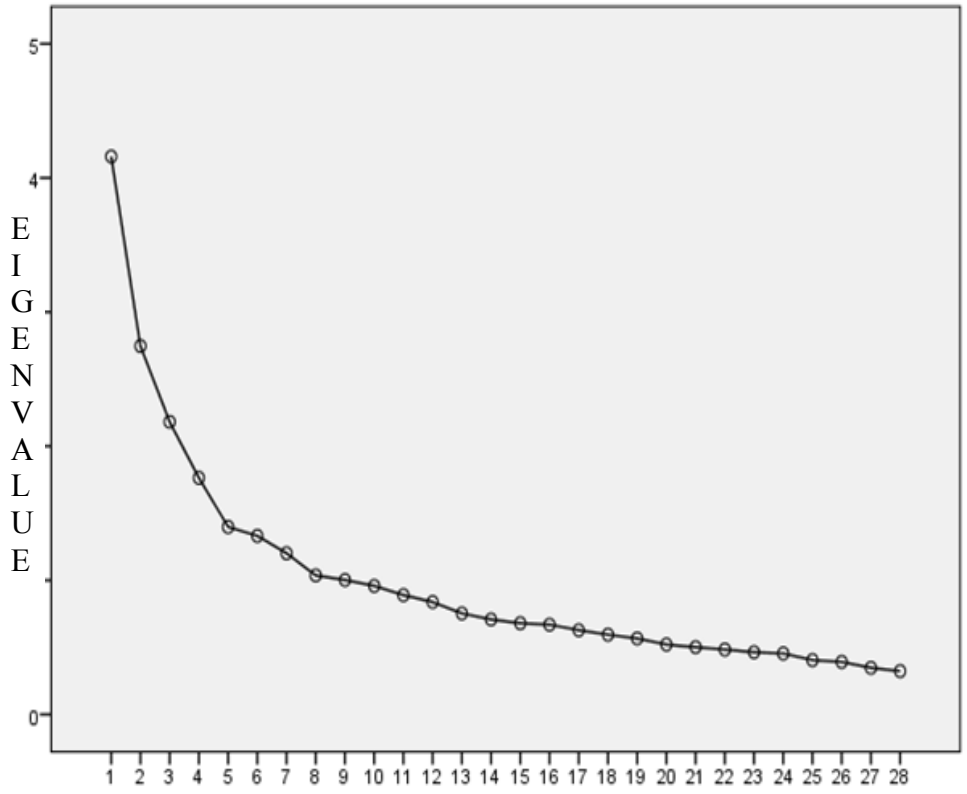

Figure 4.2. Exploratory Factor Analysis Scree Plot for the EBI

The measure passed the KMO (Kaiser & Rice, 1974) sampling adequacy test and Bartlett's Test of Sphericity (Bartlett, 1954). To produce an accurate picture of the constructs of epistemological development for this project and in keeping with similar studies containing factor analyses on the topic (Schraw et al., 2002; Welch & Ray, 2013; Wheeler, 2007), a minimum of three items loading above .400 on each factor were held as restrictions. The items were also required to have no cross-loading on another factor above .360. The first EFA produced four factors with the required loadings. The fifth potential factor had two items loading above .400 with no significant cross-loadings. Both items EBI 18 (cross-loading at .379 on Factor 2 and at .448 on Factor 5) and EBI 23 (cross-loading at .353 on Factor 1 and at .333 on Factor 5) were close to establishing

Factor 5 with the necessary third item. Because the EFA produced factors and loadings close to meeting the established requirements, low loading items were removed one by one to try to improve the fit of a new model. Item EBI 22 loaded lowest on all factors (highest score .295 on Factor 5) and the EFA was performed again without that item first. Item EBI 7 (highest loading at .338 on Factor 4) was eliminated to try to reduce the cross-loadings of other items, but the values didn't change significantly. The next non-significant item, EBI 21 (highest loading .359 on Factor 1), was removed. As a result, the lower value for item EBI 23 cross-loading on Factor 1 became insignificant and simultaneously, it elevated its loading on Factor 5. The cross-loading on item EBI 18 was improved, but still slightly significant. Figure 4.3 on the following page shows the emerging five factor model with at least three items loading above .400 with no significant (above .360) cross-loadings. The colors in the figure express a conceptual picture of how the items were originally hypothesized and then redistributed among new factors. Tables A.1 – A.3 (Appendix A, pages 80 – 83) show this with more detail, including the factor loadings.

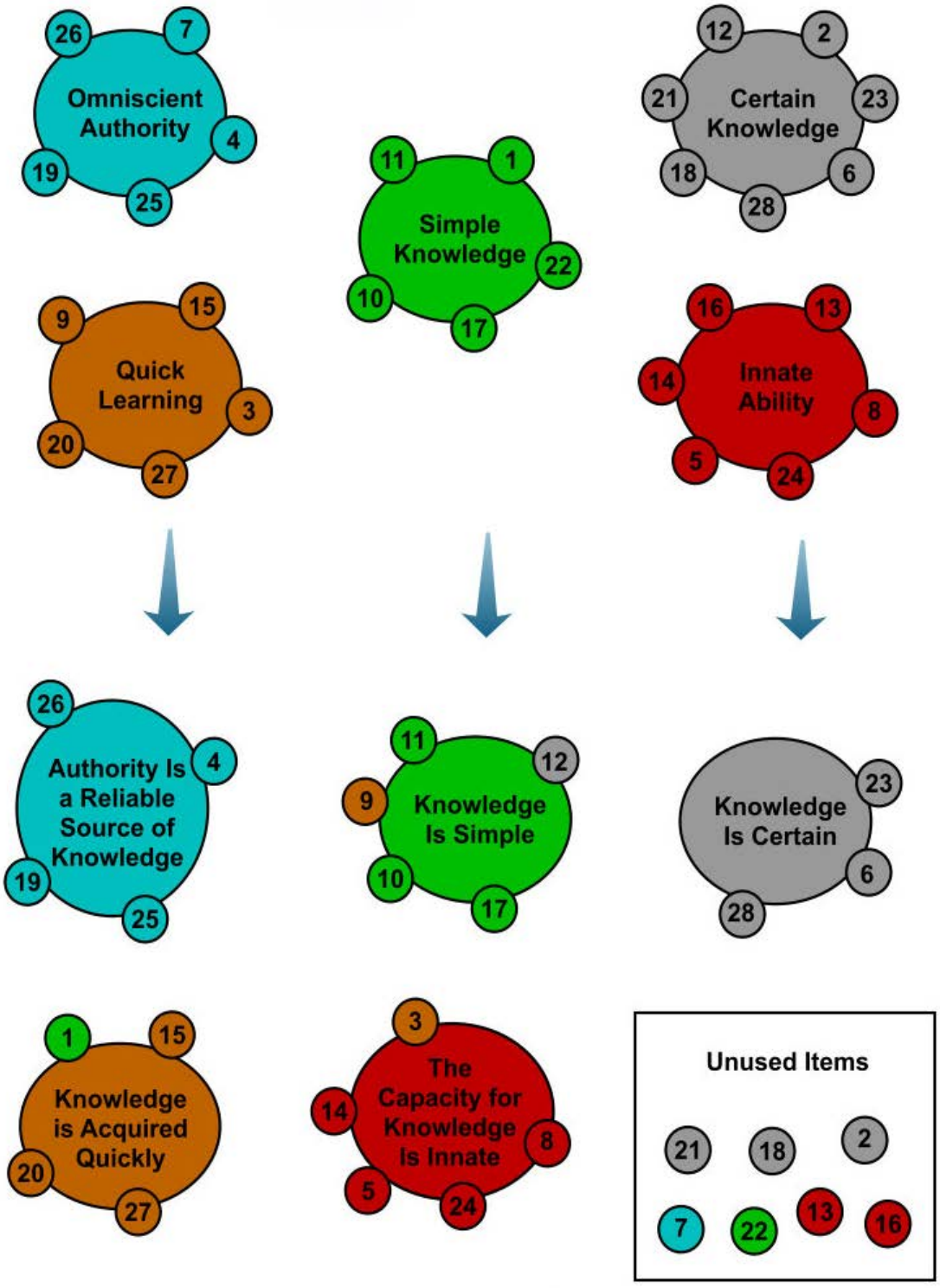

Figure 4.3. Graphic representation of Exploratory Factor Analysis of the EBI including new factor structure and unused items

This figure captures the factor loadings gathering around five new components. These components are the gathering points for communality among the survey items. The data collected by the EBI in this sample drove an alternative factor model. Foundational to the results of the rest of the study, because it outlines how epistemic beliefs are gathering into particular elements around the data, Table A.2 in Appendix A on page 81 more specifically shows how the original questions of the EBI fit a new factor structure resulting from the EFA. Reporting an alternative factor structure is consistent with other studies, such as Wheeler's (2007) study which used the EBI to examine epistemic beliefs in order to compare them to a new measure for mathematics. The five factor structure suggested by this EFA is similar to the original construct suggested by the first scholar to attempt to quantitatively measure epistemological beliefs, Marlene Schommer (1990). However, the new model's factor structure contains some important distinctions. These distinctions are examined below.

Factor 1, the Capacity for Knowledge is Innate (CKI), shares four of the original items intended for Schommer's Innate Ability construct. The additional item, EBI 3, "Students who learn things quickly are the most successful," intended to target Quick Learning, contains language about learning capability and this may explain its connection to this new factor. Each of the other items contain the words "smart" or "intellectual," implying that intelligence is central to acquiring knowledge. Item EBI 13, which fell out of the EFA with this sample, does imply Innate Ability, but it doesn't specify intelligence, learning or knowledge and that may explain why it fails to load on this factor.

Factor 2, Knowledge is Acquired Quickly (KAQ), contains three of the original items aimed at Quick Learning. The additional item, EBI 1, "Most things worth knowing are easy to understand" targeted Schommer's Simple Knowledge construct, but loaded here on Factor 2. Alternatively, EBI 9, which was intended to measure Quick Learning, loaded onto the new Factor 3, Knowledge is Simple.

Factor 3, Knowledge is Simple (KS), is made up of three of the original items targeted at measuring the Simple Knowledge construct hypothesized by Schommer. It also includes two additional items. EBI 12 loaded on Factor 3 despite being originally aimed at measuring Certain Knowledge. The question is double-barreled (Driscoll, 2011) in that it asks about what instructors should do and challenges the respondent to consider the differences between facts and theories and that may explain why it shifted. The remaining item collecting on this factor, EBI 9, "If a person tries too hard to understand a problem they will most likely end up being confused" was aimed at measuring effort. However, since it is gathering with the other items forming Knowledge is Simple, this suggests that it was interpreted as having more to do with the difficult nature of the theoretical "problem" than a person's effort to understand.

All four items composing Factor 4, Authority is a Reliable Source of Knowledge (ARSK), aligned with their Omniscient Authority predecessors. Interestingly, item EBI 7, also targeted at Omniscient Authority, did not load highly enough on this or any other factor.

Factor 5, Knowledge is Certain (KC), is composed of three original items targeted at Certain Knowledge.

Of the seven items that either contained cross-loading or low loading values, three were targeted for Certain Knowledge. Two of these, EBI 2 and EBI 18, contained language about absolute truth and relative opinion. The third, EBI 21, is the only item to contain wording referring to a particular school subject. It, along with EBI 7, also received low loadings in Wheeler's (2007) study.

EFA for the Social Influences Survey. For consistency, the process used for the EBI EFA, a Principal Components Analysis with a Varimax rotation, was used for the SIS EFA. Other options were considered, but this choice was also made to emphasize the patterns emerging from the data (Brown, 2009). The Exploratory Factor Analysis for the SIS produced the factors and loadings as shown in Table A.4 (Appendix A, page 83). Three factors were forced on the initial test in compliance with the theory on social influences and in accordance with the scree plot (Figure 4.4, below):

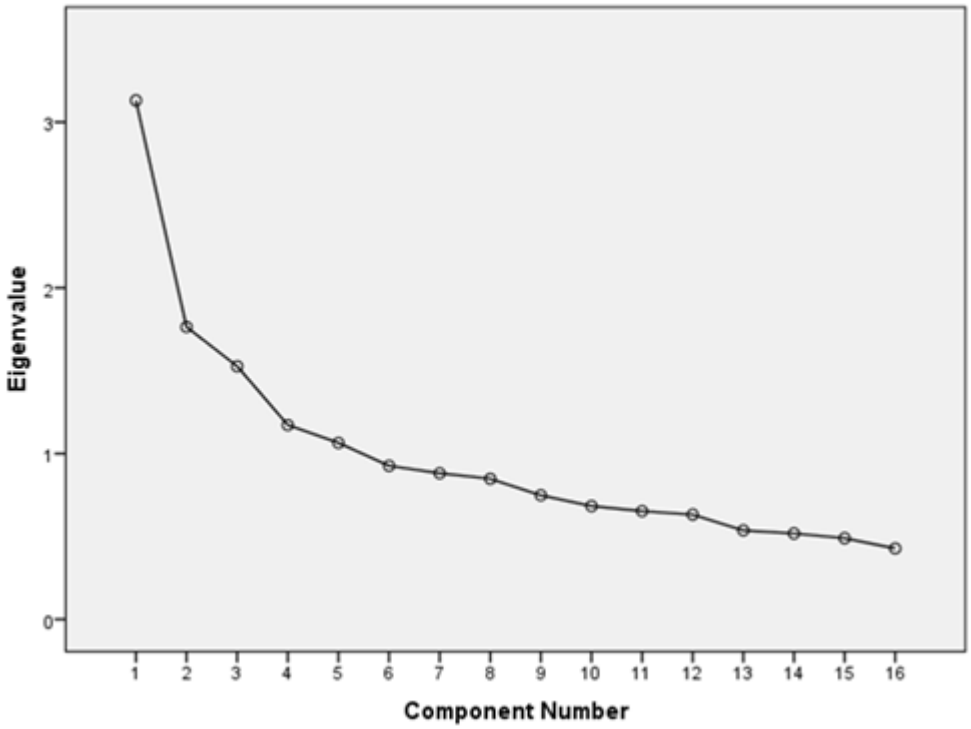

Figure 4.4. Exploratory Factor Analysis Scree Plot for the Social Influences Survey

The measure passed the KMO (Kaiser & Rice, 1974) sampling adequacy test and Bartlett's Test of Sphericity (Bartlett, 1954). The minimum factor loading (.400) and cross-loading (.360) values were retained as qualifiers for consistency's sake. Item SIS 8 loaded lowest on all factors (highest loading .320). Item SIS 9 loaded poorly as well (-.340 on factor 3). Item SIS16 cross-loaded lowly on Factor 1 (.382) and moderately on Factor 3 (.570). The EFA was performed again without SIS 8 and SIS 9 and this reduced the lower value cross-loading on SIS 16 to (.355) and increased its loading onto Factor 3 to .617, creating an acceptable level of difference. Figure 4.5 on the following page demonstrates an acceptable factor structure based on these bounds. Using a color scheme, the figure also conceptually captures the way in which the originally targeted items gathered around new factors. A more detailed outline of this distribution is captured in Tables A.4 – A.6 (Appendix A, pages 83, 84).

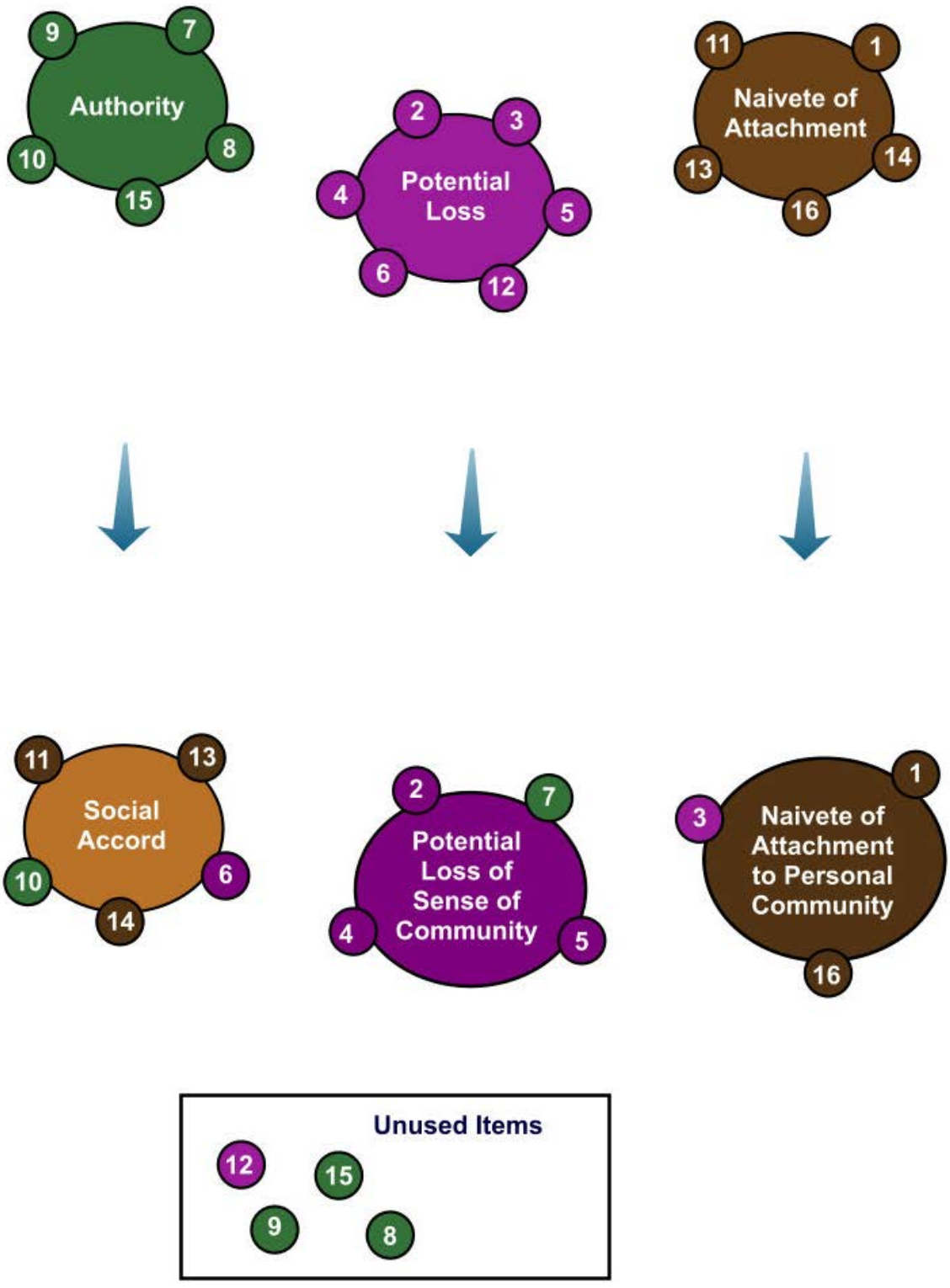

Figure 4.5. Graphic representation of Exploratory Factor Analysis of the SIS including new factor structure and unused items

These data suggest that three concepts underlie the responses to the SIS for this sample, which is important in exploring answers to the original research question regarding the relationship between social influences and epistemic beliefs and offering insight for the new objective of suggesting improved measurement and potential future study. Some preliminary reasoning is presented as to why these factors are being suggested by the data, but the significance of the resulting new factors will be commented on more thoroughly in the Discussion section of the dissertation. Table A.5 (Appendix A, pages 83, 84) more specifically shows how the original questions of the SIS showed communality among three latent components. These are Factor 1: Social Accord, Factor 2: Potential Loss of Sense of Community (PLSC), and Factor 3: Naiveté of Attachment to Personal Community (NAPC). Differentiation between the items and their factor loadings seem to fall along lines of proximity. Those loading on Factor 1 deal with more distal social influences, while those loading on Factor 2 and Factor 3 primarily result from proximal relationships, which is evocative of Bronfenbrenner's Bioecological Model (1994). Social Accord has been selected to describe the first construct and designate the communality between the items loading on this component. The name attempts to capture the way in which the items loading on this factor are characterized by social influences originating from more distant agents. The newly named Factor 2, Potential Loss of Sense of Community (PLSC), contained three of the items originally targeted for the Potential Loss construct. The fourth item was originally targeted at Authority. Factor 2 and Factor 3 are related in their expression of the influence of proximal processes. Both explore the power of influence of the microsystem. However, Factor 2 focuses on the potential loss of community and Factor

3, Naiveté of Attachment to Personal Community (NAPC), is centered on the sense of attachment students ascribe to their proximal relationships. Two of the items gathering around Factor 3 were originally targeted for the Attachment construct. The third was directed at Potential Loss, which could be experienced as the result of sacrificing parental investment. However, the question could have easily been read as the student's sense of attachment resulting from parental investment. Attachment to people active in the microsystem of the student is a common thread in the items loading on Factor 3.

Of the unused items, three were originally targeted for the hypothesized Authority factor. The data shows that this concept seems to have dropped out of the social influences construct and fits better with the epistemic beliefs construct, Authority is a Reliable Source of Knowledge.

Stepwise Multiple Regression

Upon reaching a plausible model and in keeping with the research strategy, subscales were introduced to calculate potential statistical relationships between epistemic beliefs and social influences. Iterations were run for each of the subscales to check for multicolinearity. The highest VIF (Variance Inflation Factor) value was 1.55, so it is unlikely there was multcolinearity among both EBI and SIS subscales.

For each new epistemic belief factor, a stepwise regression was performed to determine significant relationships between each and the social influences factors, all resulting from the EFA. In each reported case, the Durbin Watson (Durbin & Watson, 1950, 1951) values fell within acceptable ranges, signifying no autocorrelation. Each ANOVA was significant indicating the regression is likely a valid model. Tolerance levels fell above 0.20 indicating insignificant multicolinearity. The histograms, P-Plots,

Regression Standardized Predicted Values all passed the eye-test indicating likely acceptable levels of normality and heteroskedasticity. A more detailed analysis of the statistics emerging from all five stepwise regressions is presented in Tables A.8 – A.12 (Appendix A, pages 86, 87). The relationships that proved to be statistically significant are included in Table 4.4 below:

Table 4.4

Statistically Significant Stepwise Multiple Regression Results

EBI New Factor	Modifying Factors (SIS)	Corre-lations	R Square	ANOVA (sig)	Betas*
Authority is a Reliable Source of Knowledge	Social Accord Naiveté Attachment	-.480 -.342	0.23 0.27	.000 .000	-0.41 -0.21
Knowledge is Certain	Social Accord Naiveté Attachment	-.423 -.276	0.18 0.20	.000	-0.37 -0.16
Knowledge is Acquired Quickly	Potential Loss	-.185	0.03	.000	-0.19
Knowledge is Simple	Social Accord Potential Loss	-.142 -.134	0.02 0.03	.006 .003	-0.12 -0.11
Capacity for Knowledge is Innate	Social Accord	-.134	0.02	.010	-0.13

*Betas Standardized

As predicted, some social influences factors held negative relationships with epistemological factors, which provided some insight to the research question of this study. This is represented both by the correlations and stepwise process. Generally speaking, students with higher SIS values scored lower on EBI constructs and students who scored higher on EBI factors scored lower on SIS constructs. More specifically, the regression model determined that Social Accord and Naiveté of Attachment to Personal Community together account for 27.1% of the variability in responses to questions dealing with Authority is a Reliable Source of Knowledge. This variability, along with

the negative correlations, loosely implies that students who have a firm sense of belonging within broader social contexts also have a deeper sense of reliance upon authority for informing their epistemology. Students with a strong dependence upon authority also held significant Naiveté of Attachment to Personal Community values in the study. Social Accord and Naiveté of Attachment to Personal Community also accounted for 20.2% of the variability in responses to items common to Knowledge is Certain. This implies that students potentially hold more tightly to norms imposed by both peer and family influences and more remote environmental agencies and that these norms may include beliefs about confidence in knowing. This indicates that there are social influences at work providing obstacles to epistemological development and that conversely; students with generally more mature epistemologies are not as restricted by their social influences. Other negative relationships were revealed, but they only accounted for small amounts of variability.

Several hypothesized relationships were non-significant, according to the regression model. In particular, it is interesting that Potential Loss and Naiveté of Attachment were relevant to particular EBI constructs and not significant for all of them. It is also interesting that Social Accord was more strongly related to each epistemic belief construct except Knowledge is Acquired Quickly. Reasoning for these relationships is explored more fully in the Discussion chapter.

Hierarchical Multiple Regressions

In keeping with the intention of the study to examine the predictive ability of social influences above and beyond the variance created by the demographic variables, additional regressions were also run hierarchically. These were performed separately

with each of the five epistemic beliefs constructs as the unique dependent variable. The data set used for the hierarchical regression reflects the removal of cases related to small demographic populations and missing values (total sample size is 343).

The regression results show that adding the SIS subscale means to the model increased the model's ability to predict each epistemic belief factor above and beyond the demographic variables. A more detailed presentation of each hierarchical regression appears in Tables A.13 – A.17 (Appendix A, pages 87 – 91). Table 4.5 shows the R Square Change values which indicate the strength of the model's predictive capacity beyond the demographic variables:

Table 4.5

Statistically Significant Hierarchical Regression Results

Epistemic Belief Factor	R Square (demographic)	R Square (SIS Factors)	R Square Change
Authority is a Reliable Source of Knowledge	0.04	0.30	0.27
Knowledge is Certain	0.02	0.25	0.23
Knowledge is Acquired Quickly	0.03	0.08	0.05
Knowledge is Simple	0.03	0.08	0.04
Capacity for Knowledge is Innate	0.03	0.06	0.03

Statistically, the SIS subscale means produced the strongest relationship above and beyond demographics with the Authority is a Reliable Source of Knowledge construct, increasing the percentage of variance accounted for in the model by 26.6 %. All three SIS subscale mean scores produced significant negative relationships with the ARSK construct. Additionally, the statistical relationship between the Knowledge is Certain EBI subscale means and the SIS subscale means proved to be the second

strongest result from the five hierarchical regressions. Above and beyond the effects of the demographic variables, which proved to be statistically insignificant when taken collectively, adding the SIS subscale means solidified the model's predictive capacity to predict a student's belief in Knowledge is Certain in a statistically significant way and is increasing the percentage of variance accounted for by 22.6%.

The Standardized Betas from the models support the negative correlations as reported in the stepwise regression results. Overall, higher scores on the EBI factor subscales were significantly associated with lower scores on the SIS subscales. The converse also holds true: that lower EBI factor means are associated with higher SIS subscale means. For clarity, it should be noted that high scores on an EBI subscale theoretically indicate that a student is more mature in their development and believes less strongly in that simplistic concept of knowledge. Furthermore, low scores on the EBI factors generally designate a less mature epistemological development and a stronger belief in the particular construct (Schraw et al., 2002). Therefore, given that the factor structures are somewhat unstable, it can be generally asserted that there is potential for social influences to predict epistemic beliefs. This confirms the importance of improved measurement and continued study on the topic.

Chapter 5

Discussion

The following discussion centers on both the original research question and the new objectives that emerged from the data analysis. Regarding the research question, focus will be placed on how the data brings conversation to the relationship between social influences and epistemic beliefs. The first discussion will focus on the ways constructs emerged from the factor analyses. Once possibilities regarding these factors have been expressed, the results from the regression analyses drive conversation about the relationships between them. Finally, in response to the factor analyses producing acceptable, but less than desirable loadings, suggestions for future measurement and potential future study topics will be discussed.

The Relationships Between Social Influences and Epistemic Beliefs

Implications of the factor analyses.

Social influences and authority. As a result of previous studies on the EBI, the Omniscient Authority construct was expected to prove troublesome in the EBI CFA and emerge as a solid factor from the SIS EFA. The statistics from the EFA show that it actually fit better within the EBI structure and fell out of the SIS. This implies that in terms of epistemic beliefs, Authority as a Reliable Source of Knowledge should be distinguished from the nature of authority as a social influence. It is significant to remember that Schommer conceived of development along a continuum between relying on authority as a source of knowledge and personally constructed beliefs about knowledge (DeBacker et al., 2008). This established that student growth was equated with the self-authorship of epistemic beliefs. The analysis supports that authorities are

considered sources of knowledge, but serve a dual role as influential social agents. This second role seems to operate within both communal and larger societal systems, as reflected by the originally conceived Authority construct being absorbed into the newly observed SIS factors. The SIS EFA suggests that these authorities as relational influences are more accurately measured by their effects as operators within the factors Social Accord, Naiveté of Attachment to Personal Community, and Potential Loss of Personal Community. Clearly, these dual roles should be measured and analyzed separately. Maintaining this distinction may improve future studies of epistemic beliefs and social influences. Greater insight into the epistemological development change process will likely be gained as authority as source of knowledge is explored and its function as a relational influence within community and culture is separately clarified.

It is of interest that the majority of items that fell out of the EFA of the SIS shared this theoretical connection. It is possible that other social influence factors could exist and such data justifies explorations of other potential contextual inhibitors to the developmental process.

Social influences and the Bioecological Model. The Bioecological Model (Bronfenbrenner, 1994) has informed the shaping of new constructs emerging from the EFA of the Social Influences Survey. The emergence of the new factor, Social Accord, brought attention to the idea that SIS factors divided along the lines of immediacy. Results from this study show that maintaining social cohesion through one's epistemic beliefs is a likely moderator in epistemological growth. A further question to explore is whether or not, or more likely, to what degree, can one take on an expanded view of beliefs without losing connection with one's broader social context. Generally, the

differences in the originally hypothesized and newly formed constructs could be characterized by their proximity to the student. Bronfenbrenner (1994) hypothesizes that proximal processes – those closest to the student – have the most impact on development. The results of the SIS have inadvertently brought the significance of these relationships to light. Family, friends, and local communities are integral parts of the Potential Loss and Naïveté of Attachment factors and those expressed by items connected to Social Accord are related to more remote societal influences such as religious, racial, and potential romantic partners (distinctively, I am assuming the difference between potential romantic partners from actual ones). While these are certainly significant, they are less embodied locally. This is to say that their processes of influence are not necessarily less personal, but much less firsthand. When describing proximal processes, Bronfenbrenner (1994) notes the significance of constantly active interactions. Those relationships that are more central to person's daily life, those that they most frequently interact with, are the most influential. Interestingly, Social Accord produced consistent, significant results among all of the epistemic belief categories. As a result, its importance in future studies of the epistemological developmental process should be maintained and possibly even explored as a control variable. Based on the results of the study, it could be argued that societal pressures embodied in distal agents are highly significant. However, keeping the Bioecological Model in mind, it is likely these pressures to hold onto epistemic beliefs espoused by at-large social agencies may be expressed through proximal relationships as well. It would be interesting to explore how distal pressure to maintain epistemic beliefs is being communicated to students.

Evidence for cultural socialization also exists from social psychological studies. Pizzolato and her co-authors (2012) note one of which that claimed "the community's idea of what it means to be a person (in terms of culturally shaped notions of how to be in relationships) is key to understanding how people understand the concept of self" (Markus, Mullaly, & Kitayama, 1997). These key community influences shaped solidarity through identification. In terms of this study, the factors resulting from the EFA of the SIS could be interpreted as reflecting these relational dynamics. The formation and alteration of epistemic beliefs is mired in communal influence. Understanding the way development happens is kindred with understanding the exchanges of proximal relationships and less-proximal social agents. Further distinguishing survey items along the lines of proximity to the student may improve the measurement of social influences. This in turn may lead to strengthening conclusions about epistemological development and ultimately, educational strategies.

Potential Loss of Sense of Community. As a result of the factor analysis, the originally conceived Potential Loss construct was further differentiated to include losing a sense of community. This is mainly a result of the fourth SIS item "I grew up in a strict environment", which was incipiently targeted at Authority, potentially being interpreted by students for its emphasis on family. Originally intended to help evaluate the strength of authority in a student's life, it may have actually measured the comfort level attributed to a strict upbringing. In other words, losing the comfort of having decisions made for students by their parents may be at stake in this question rather than the power of authority in one's life. The emotional connection of that relationship and its closeness to the student has potentially been more readily interpreted by those who took the survey.

Pizzolato and her co-authors (2012) produced evidence in interviews that such relationships theoretically take on more psychological significance, making it more difficult for students to become self-authors. These influences can be embodied in on-campus relationships and even contribute to the dissonance at hand during provocative moments. These authors also emphasize that epistemological development can be equated with how well a student manages her social influences as she becomes more aware of them. Future measurements of social influences may take advantage of the clarity brought to this dynamic from this study. Items targeting ways in which a student is both aware of and manipulates the emotions surrounding beliefs about knowledge and their sense of belonging in a larger community may enhance both statistical and conceptual analysis.

Implications of the regression results. The regression models show that epistemic beliefs are negatively related to social influences. The hierarchical regression results emphasize that this is indeed the case above and beyond demographic variance. While the weakness of the loadings of the factor analyses can challenge overt claims about the nuances of this relationship, it generally exists. There is evidence that students with tighter ties to their social influences are also more likely to resist change in epistemic beliefs. Conversely, students who have weaker ties to their social influences change more readily.

Based on the stepwise regression evidence, students who believe more strongly that Authority is a Reliable Source of Knowledge also have stronger connections to Social Accord and exhibit more Naiveté of Attachment to Personal Community. These two social influences constructs were also related to Knowledge is Certain. These

relationships proved statistically significant, but because of the weak factor analysis, distinct claims about the specifics of these relationships should be avoided. Therefore, continued research is recommended to determine the interplay of these constructs. This research should focus on which information outlets are serving as sources of authority. Future studies could also work to expand our understanding of what types of agents are functioning to influence Social Accord and how the relationships between students and agents function. Because of the strong statistical relationship, there are likely key connections to be explored between sources of authority, communication styles, remote social interactions, and beliefs about the simplicity and certainty of knowledge claims.

A statistically significant relationship was shown between the Knowledge is Acquired Quickly and Potential Loss of Sense of Community constructs. The connection may be attributed to a general attitude of path of least resistance, or reward without risk. Evidence for this can be found in the thematic similarity of item composition within these factors. Many of the questions within the PLSC construct are questions of threat and high responses on the subscale may indicate a reticence to risk. Similarly, items within the KAQ construct suggest that acquisition has less to do with knowing and is more about effort. Logically, it seems students with a greater fear of loss of relationships may also be less risky and this may impact their attitude toward discovering knowledge. Future measurement devices could use items to differentiate study habits and risk/reward scenarios, and delve further into the nature of loss as it concerns changing epistemic beliefs. The data shows that the connection is significant, although less than strong, so deeper conclusions about this relationship would need to be explored more carefully.

Limitations

The results of the current study are subject to some limitations. The sample was drawn from a medium-large Southeastern university. Although it was random and approximately representative of the population in terms of race, the sample was predominately white (85%) and the sample populations for racial groups were small. The sample was also predominantly female (73%) and not representative of the population (estimated 56% female). These sample characteristics should be considered when interpreting the findings of the current study.

While every effort was made to produce reliable factor analyses, the analyses produced loadings that were less than desirable. This study indicates that theory and subsequent anticipated constructs and of epistemic beliefs and social influences should continue to be clarified and pursued. While this is consistent with other epistemological studies, these limitations should be kept in mind.

Implications for Measurement

The factor analyses suggest that the original concepts of both epistemic beliefs and social influences prove problematic for quantitative analysis. While new factor structures were composed based on statistical results, they also contained less than desirable loadings. Such results echo previous studies which suggested the EBI was a dubious measurement device that needed fine tuning (Welch & Ray, 2013). The current study, because of its exploratory nature, attempted to use the EBI in its traditional form to maintain consistency with the literature. This consistency legitimizes the results to a degree, but it also limits the strength of the implications of the study for higher education because of the limitations of the EBI. As a result, the more powerful conclusions about

the study center on clarifications among concepts for future measurement. Furthermore, conclusions have also been limited to emphasizing only the stronger relationships among new factors. While these are certainly beneficial, improved measures for epistemic beliefs and social influences could more significantly impact strategies for higher education. The results of this study have revealed a deeper need for progressing toward more accurate measurement devices.

Based on the way EBI items spread among the originally intended constructs and the new factors, more clearly distinguishing the nature of epistemic beliefs would help produce a more robust factor structure. Evidence shows that students seemed to interpret questions in regard to learning rather than beliefs about knowledge, noted particularly by the cross-loadings and low loadings aimed at the original Certain Knowledge construct. This is easy to understand, given the way concepts like certainty, simplicity, knowledge acquisition, and the Speed of Knowledge (Schommer, 1990) have a role in the learning process. While it may not be advisable to completely remove ideas about learning from the constructs of epistemology, these need to be more clearly defined or queried about. For instance, item, EBI 1, "Most things worth knowing are easy to understand", targeted Schommer's Simple Knowledge construct and the word, "easy", could have been interpreted as having to do with acquiring knowledge rather than naming its simple or complex nature, and as such loaded on the new Factor 2, Knowledge is Acquired Quickly. Conversely, EBI 9, which was intended to measure Quick Learning, loaded onto the new Factor 3, Knowledge is Certain, and may have been interpreted to suggest the difficult nature of the information itself rather than the ability to learn it quickly. Words like "understand" and "confused" may have directed students toward thinking

about simplicity of the concept at hand rather than how quickly it could be learned. The EFA raises questions about how students differentiated between the nature of knowledge and the processes of learning. Authors of future measurement devices should use clearly established theories on these topics and be careful to intentionally ask about the two processes in ways that can be differentiated.

Social influences and authority. Since this study has clarified the role of authority as a source of knowledge rather than a social influence, it is suggested that concepts like parental influence and peer pressure fit better within the SIS under the domain of ties to personal community. Future measures might include items focused on keeping these two aspects of authority distinct. The resulting measurement devices may more accurately establish social influences constructs focused on the significance of loss and attachment rather than on authority.

Renewed emphasis on Social Accord. While emerging as a new concept from the factor analysis of the SIS, Social Accord accounted for the strongest negative relationship with epistemic beliefs almost unilaterally throughout the study. In considering modifications to measurement, more attention should be paid to this factor of social influences. Since the construct includes items that mention religion and race tangentially, these sources of beliefs should be further explored. Other potential social institutions or agents that operate more remotely from students, such as political figures, counselors, or teachers could also be examined to determine if they additionally contribute to a Social Accord construct. Because of the manifestation of significant differences in the effects between proximal processes and more remote socialization, future studies can make use of these distinctions. In particular, studies could examine

larger cultural forces such as religion, race, and other values-creating systems and their interplay with epistemic beliefs formation. Insight is likely to be gathered from the way values about knowledge are communicated through each of the ecological systems – micro, meso, exo, and macro. Exploring each of these environments individually could unearth keys to the ways in which students wrestle with the interplay of relationships, socialization, and epistemological doubt. Of the conclusions to be drawn from this project, the data supports that further examination into the construct of Social Accord as a social influence is the most warranted.

Terminology. Some of the confusion surrounding factor loadings could be the result of using controversial and often misunderstood terms. Based on the way items containing words like "facts", "theories", "understand", "truth", and "opinion" shifted or fell out of the factor analysis, it appears they may have added to the ambiguity of the results of the survey. However, these are terms associated with epistemology and learning processes. It would be tempting to simply remove these types of enigmatic and controversial words to see if they produced better factor loadings. The challenge is to find more specific item wording, yet also retain the important concepts these terms represent. A potential solution is to operationalize the meanings of these words in an introduction to a future survey. In such a case, researchers could establish clear discussion points based on how the results verified, modified, or contradicted a particular representation of the terms.

Conclusion

The factor loadings that emerged from the study proved to be less than optimal. However, the resulting factor structure driven by this sample did produce consistent

statistically significant relationships. Analyzing these connections and measurement limitations has produced worthwhile insight that can be applied to future considerations for study. The constructs have been clarified, which has produced a small gain in understanding what could be occurring during the change process of epistemological development. It is clear that proximal relationships have a different impact than more distant ones. Those shaping broader social contexts also have more significant ties to authority as a source of knowledge. Less insight was gathered about attachment and fear of loss of community, but because the results revealed that social influences do affect the development of epistemic beliefs, further research is needed to clarify how these constructs are operating together.

This investigation was initially conceived with the hope of informing higher education practice about potential applications that may emerge from exploring the relationship between social influences and epistemological development. Although the statistics accumulated show that more is needed to be discovered to achieve that goal in specific ways, some evidence for the value of examining the interplay between these constructs has emerged. Greater understanding for what students are experiencing as they change and grow will accompany researchers as we continue to wrestle with the significance of epistemological development for education. Simple understanding can ease student transitions, but additional clarification is needed to fully implement changes in practice. The accrued data has revealed that continued exploratory analysis is required to move closer toward application to higher education. This study is an example of a necessary step in that process.

Appendix A

Detailed Statistical Tables

Table A.1: *Final EFA Factor Loadings for the EBI*

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
EBI24	**.698**	.022	.146	-.096	.149
EBI3	**.667**	.116	-.087	.041	-.017
EBI8	**.649**	-.090	.136	.054	-.035
EBI14	**.620**	.224	-.018	.066	-.020
EBI5	**.607**	.111	-.051	-.166	.092
EBI15	.348	**.659**	.198	-.055	-.008
EBI20	.142	**.639**	.170	.014	.052
EBI27	.184	**.634**	.293	.079	.028
EBI2	.108	-.499	-.104	-.051	.424
EBI13	.270	-.482	.378	.087	-.003
EBI1	.019	**.429**	.149	.201	.260
EBI10	-.035	.209	**.688**	.158	-.032
EBI12	.002	.087	**.637**	.082	.228
EBI17	-.042	.173	**.588**	.121	.091
EBI9	-.013	.265	**.517**	-.042	-.139
EBI11	.078	-.002	**.516**	-.019	-.033
EBI16	.409	-.042	.447	-.003	-.137
EBI26	-.012	.209	.081	**.754**	.163
EBI25	.057	-.190	.026	**.745**	-.196
EBI4	-.055	.115	.086	**.719**	.105
EBI19	-.130	-.047	.111	**.599**	.255
EBI7	.256	.129	-.063	.332	.281
EBI28	-.132	.045	-.102	.012	**.734**
EBI6	-.008	-.256	.155	.253	**.605**
EBI18	.190	.382	.184	.071	.476
EBI23	.250	.236	-.050	.211	**.439**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 7 iterations.

Key:
- loading significantly on a factor
- significantly cross-loading on at least two values (absolute value .360 and higher)
- loading lowly (below .400)

Table A.2:

EFA EBI Component Characteristics

Item	Question	Intended Factor	Component	Loading
EBI 24	Smart people are born that way.	Innate Ability	Capacity for Knowledge is Innate	.698
EBI 3	Students who learn things quickly are the most successful.	Quick Learning		.667
EBI 8	Really smart students don't have to work as hard to do well in school.	Innate Ability		.649
EBI 14	How well you do in school depends on how smart you are.	Innate Ability		.620
EBI 5	People's intellectual potential is fixed at birth.	Innate Ability		.607
EBI 15	If you don't learn something quickly, you won't ever learn it.	Quick Learning	Knowledge is Acquired Quickly	.659
EBI 20	If you haven't understood a chapter the first time through, going back over it won't help.	Quick Learning		.639
EBI 27	Working on a problem with no quick solution is a waste of time	Quick Learning		.634
EBI 1	Most things worth knowing are easy to understand.	Simple Knowledge		.429
EBI 10	Too many theories just complicate things.	Simple Knowledge	Knowledge is Simple	.688
EBI 12	Instructors should focus on facts instead of theories.	Certain Knowledge		.637
EBI 17	Things are simpler than most professors would have you believe.	Simple Knowledge		.588
EBI 9	If a person tries too hard to understand a problem, they will most likely end up being confused.	Quick Learning		.517
EBI 11	The best ideas are often the most simple.	Simple Knowledge		.516

EBI 26	People shouldn't question authority.	Omniscient Authority	Authority is a Reliable Source of Knowledge	.754
EBI 25	When someone in authority tells me what to do, I usually do it.	Omniscient Authority		.745
EBI 4	People should always obey the law.	Omniscient Authority		.719
EBI 19	Children should be allowed to question their parents' authority.	Omniscient Authority		.599
EBI 28	Sometimes there are no right answers to life's bigger problems.	Certain Knowledge	Knowledge is Certain	.734
EBI 6	Absolute moral truth does not exist.	Certain Knowledge		.605
EBI 23	What is true today will be true tomorrow.	Certain Knowledge		.439

Table A.3

Unused items for the EFA on the EBI

Item	**Question**	**Targeted Construct**	**Issue**
EBI 22	The more you know about a topic, the more there is to know.	Simple Knowledge	Loaded low across all factors (.295)
EBI 7	Parents should teach children all there is to know about life.	Omniscient Authority	Loaded low across all factors (.338)
EBI 21	Science is easy to understand because it contains so many facts.	Certain Knowledge	Loaded low across all factors (.359)
EBI 2	What is true is a matter of opinion.	Certain Knowledge	Cross-loaded on Factors 2 & 5
EBI 13	Some people are born with special gifts and talents.	Innate Ability	Cross-loaded on Factors 2 & 3
EBI 16	Some people just have a knack for learning and others don't.	Innate Ability	Cross-loaded on Factors 1 & 3
EBI 18	If two people are arguing about something, at least one of them must be wrong.	Certain Knowledge	Cross-loaded on Factors 2 & 5

Table A.4

Final EFA Factor Loadings for the SIS

Rotated Component Matrix[a]

	Component		
	1	2	3
SIS10	**.673**	.205	.042
SIS6	**.635**	.196	.342
SIS14	**.608**	-.159	-.211
SIS11	**.606**	.142	.170
SIS13	**.442**	.067	.146
SIS5	.061	**.713**	-.217
SIS7	-.011	**.650**	.121
SIS12	.473	.604	-.115
SIS4	.191	**.540**	.077
SIS2	.044	**.428**	.112
SIS3	-.011	.148	**.725**
SIS16	.355	-.233	**.617**
SIS15	-.122	.414	.580
SIS1	.209	-.057	**.527**

Extraction Method:
Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Key:
- loading significantly on a factor
- significantly cross-loading on at least two values (absolute value .360 and higher)
- loading lowly (below .400)

Table A.5

EFA SIS Component Characteristics

Item	Question	Intended Construct	Component	Score
SIS 10	I defer to religious leaders when I think about truth	Authority	Social Accord	.673
SIS 6	I make sure my dating partners have the same beliefs as me.	Loss		.635
SIS 14	As a result of my experiences travelling in other cultures, I adjusted my beliefs.	Attachment		.608
SIS 11	I feel a strong attachment toward my own racial/ethnic group	Attachment		.606

SIS 13	I rarely have doubts about my lifestyle or beliefs	Attachment		.442
SIS 5	If I accepted a person of difference, it would cause conflict with my family.	Loss	Potential Loss of Sense of Community	.713
SIS 7	I grew up in a strict environment	Authority		.650
SIS 4	If I changed my mind about my beliefs, I'd lose a lot of friends.	Loss		.540
SIS 2	I feel threatened when challenged by new people or ideas.	Loss		.428
SIS 3	My parents have a lot invested in me.	Loss	Naiveté of Attachment to Personal Community	.725
SIS 16	When I have doubts about my beliefs or lifestyle, I talk to people at home about them.	Attachment		.617
SIS 1	I was/am part of a close-knit community where I grew up.	Attachment		.527

Table A.6

Unused Items for the EFA on the SIS

Item	**Question**	**Intended Construct**	**Issue**
SIS 8	Sometimes you have to accept answers from teachers even if you don't understand them.	Authority	Highest loading was .320
SIS 9	Learning depends most on having a good teacher.	Authority	Highest loading was -.340
SIS 12	I feel threatened when challenged by new people or ideas.	Loss	Cross-loaded on Factors 1 & 2
SIS 15	My parents were/are heavily involved in my college decision	Authority	Cross-loaded on Factors 2 & 3

Table A.7

Descriptive statistics and correlations for all subscales (N = 370)

Variables	ARSK	KC	KS	KAQ	CKI	SA	PLSC	NAPC
Authority Is a Reliable Source of Knowledge (ARSK)	1							
Knowledge Is Certain (KC)	.31***	1						
Knowledge Is Simple (KS)	.19***	.07	1					
Knowledge Is Acquired Quickly (KAQ)	.17***	.13*	.41***	1				
The Capacity for Knowledge Is Innate (CKI)	.05	.28***	.12*	.33***	1			
Social Accord (SA)	-.48***	-.42***	-.14**	-.9	-.13**	1		
Potential Loss of Sense of Community (PLSC)	-.16**	.001	-.13**	-.19***	-.09	.22***	1	
Naïveté of Attachment to Personal Community (NAPC)	-.34***	-.28***	-.10	.05	-.001	.31***	.031	1
Means	3.34	3.98	3.38	4.83	4.26	3.50	2.63	4.13
Standard Deviations	0.84	0.93	0.78	0.68	0.80	0.91	0.79	0.98
Range	4.75	5.00	4.40	4.00	4.00	4.40	4.50	5.00

Note: *p <.05; **p <.01; ***p <.00

Table A.8

Stepwise Regression Model of Authority Is a Reliable Source of Knowledge

	R	R^2	*B*	*SE*	β	*t*
Step 1	0.48	0.23***				
Social Accord			-.44	.04	-.48***	-10.49
Step 2	0.52	0.27***				
Social Accord			-.38	.04	-.41***	-8.82
Naivete of Attachment			-.18	.04	-.21***	-4.54

Note: Statistical significance *p<.05; **p<.01; ***p<.001

Table A.9

Stepwise Regression Model of Knowledge Is Certain

	R	R^2	*B*	*SE*	β	*t*
Step 1	0.42	0.18***				
Social Accord			-.43	.05	-.42***	-8.95
Step 2	0.45	0.20***				
Social Accord			-.38	.05	-.37***	-7.60
Naiveté of Attachment			-.15	.05	-.16***	-3.25

Note: Statistical significance *p<.05; **p<.01; ***p<.001

Table A.10

Stepwise Regression Model of Knowledge Is Simple

	R	R^2	*B*	*SE*	β	*t*
Step 1	0.14	.02**				
Social Accord			-.12	.04	-.14**	-2.75
Step 2	0.18	.03**				
Social Accord			-.10	.05	-.12*	-2.24
Potential Loss			-.11	.05	-.11*	-2.05

Note: Statistical significance *p<.05; **p<.01; ***p<.001

Table A.11

Stepwise Regression Model of Knowledge Is Acquired Quickly

	R	R^2	*B*	*SE*	β	*t*
Step 1	0.19	0.03***				
Potential Loss			-.16	.04	-.19***	-3.61

Note: Statistical significance *p<.05; **p<.01; ***p<.001

Table A.12

Stepwise Regression Model of The Capacity for Knowledge Is Innate

	R	R^2	*B*	*SE*	β	*t*
Step 1	0.13	.02**				
Social Accord			-.12	.05	-.13**	-2.59

Note: Statistical significance *p<.05; **p<.01; ***p<.001

Table A.13

Hierarchical Regression Model of Authority Is a Reliable Source of Knowledge

	R	R^2	R^2 *Change*	*B*	*SE*	β	*t*
Step 1	0.19	0.04					
Urban/Rural/Suburban				.001	.51	.001	0.02
Gender				-.24	.10	-.13*	-2.37
Mother Education				-.09	.06	-.10	-1.59
Father Education				.07	.05	.08	1.26
Multiracial				-.10	.20	-.03	-0.52
Race				.06	.04	.09	1.57
Major				.02	.02	.05	0.97
Step 2	0.55	0.30***	0.27***				
Urban/Rural/Suburban				-.05	.05	-.05	-1.15
Gender				-.17	.09	-.09	-1.91
Mother Education				-.01	.05	-.01	-0.21
Father Education				.06	.05	.07	1.28
Multiracial				.02	.17	.01	0.18
Race				.03	.03	.04	0.82
Major				.02	.02	.06	1.19
Social Accord				-.38	.05	-.40***	-7.98
Potential Loss				-.07	.05	-.07	-1.39
Naïveté Attachment				-.19	.04	-.22***	-4.32

Note: Statistical significance *p<.05; **p<.01; ***p<.001

Table A.14

Hierarchical Regression Model of Knowledge Is Certain

	R	R^2	R^2 *Change*	*B*	*SE*	β	*t*
Step 1	0.14	0.02					
Urban/Rural/Suburban				-.03	.06	-.02	-0.43
Gender				.07	.12	.03	0.58
Mother Education				-.14	.06	-.13*	-2.10
Father Education				.02	.06	.02	0.38
Multiracial				-.24	.22	-.06	-1.09
Race				.01	.04	-.01	-0.17
Major				-.004	.02	-.01	-0.20
Step 2	0.50	0.25***	0.23***				
Urban/Rural/Suburban				-.09	.05	-.08	-1.66
Gender				.13	.10	.06	1.31
Mother Education				-.05	.06	-.05	-0.88
Father Education				.01	.05	.01	0.13
Multiracial				-.07	.20	-.02	-0.37
Race				-.04	.04	-.06	-1.20
Major				-.01	.02	-.03	-0.58
Social Accord				-.44	.06	-.42***	-7.94
Potential Loss				.09	.06	.07	1.46
Naïveté Attachment				-.17	.05	-.18***	-3.33

Note: Statistical significance *p<.05; **p<.01; ***p<.001

Table A.15

Hierarchical Regression Model of Knowledge Is Simple

	R	R^2	R^2 *Change*	*B*	*SE*	β	*t*
Step 1	0.18	0.03					
Urban/Rural/Suburban				.10	.05	.11*	2.05
Gender				-.02	.09	-.01	-0.18
Mother Education				.07	.05	.08	1.25
Father Education				.01	.05	.01	0.23
Multiracial				.20	.18	.06	1.17
Race				.01	.03	.02	0.43
Major				-.02	.02	.07	-1.21
Step 2	0.28	0.08**	0.04**				
Urban/Rural/Suburban				.09	.05	.10	1.84
Gender				.02	.09	.01	0.17
Mother Education				.09	.05	.11	1.78
Father Education				.02	.05	.02	0.32
Multiracial				.24	.18	.07	1.31
Race				.01	.03	.02	0.29
Major				-.02	.02	-.05	-0.96
Social Accord				-.07	.05	-.09	-1.46
Potential Loss				-.11	.05	-.12*	-2.10
Naïveté Attachment				-.10	.05	-.12*	-2.06

Note: Statistical significance *p<.05; **p<.01; ***p<.001

Table A.16

Hierarchical Regression Model of Knowledge Is Acquired Quickly

	R	R^2	R^2 *Change*	*B*	*SE*	β	*t*
Step 1	0.16	0.03					
Urban/Rural/Suburban				.03	.04	.04	0.65
Gender				-.02	.08	-.01	-0.26
Mother Education				.04	.05	.05	0.82
Father Education				-.06	.04	-.09	-1.49
Multiracial				.39	.16	.13*	2.47
Race				.02	.03	.04	0.65
Major				-.01	.01	-.03	-0.58
Step 2	0.27	0.08**	0.05***				
Urban/Rural/Suburban				.02	.04	.03	0.55
Gender				-.01	.08	-.003	-0.06
Mother Education				.04	.05	.05	0.89
Father Education				-.06	.04	-.09	-1.53
Multiracial				.36	.16	.12*	2.31
Race				.01	.03	.02	0.44
Major				.00	.01	-.001	-0.01
Social Accord				-.06	.04	-.08	-1.44
Potential Loss				-.16	.05	-.19***	-3.41
Naïveté Attachment				.004	.04	.01	0.10

Note: Statistical significance *p<.05; **p<.01; ***p<.001

Table A.17

Hierarchical Regression Model of The Capacity for Knowledge Is Innate

	R	R^2	R^2 *Change*	*B*	*SE*	β	*t*
Step 1	0.16	0.03					
Urban/Rural/Suburban				.04	.05	.05	0.83
Gender				-.13	-.10	.07	1.35
Mother Education				-.08	.05	-.09	-1.45
Father Education				-.03	.05	-.04	-0.61
Multiracial				.30	.19	.09	1.60
Race				.02	.03	.03	0.58
Major				.01	.02	.04	0.67
Step 2	0.24	0.06*	0.03*				
Urban/Rural/Suburban				.03	.05	.03	0.55
Gender				-.15	.10	.08	1.53
Mother Education				-.07	.06	-.08	-1.25
Father Education				-.04	.05	-.04	-0.73
Multiracial				.30	.19	.09	1.60
Race				.01	.03	.01	0.22
Major				.02	.02	.05	0.91
Social Accord				-.13	.05	-.15*	-2.46
Potential Loss				-.08	.06	-.08	-1.36
Naïveté Attachment				.01	.05	.01	0.14

Note: Statistical significance *p<.05; **p<.01; ***p<.001

Appendix B

Demographic Questionnaire

D1 What is your current school year level? (if you just finished a grade, claim the next semester). NOTE: If you are younger than 18, you may not complete the survey.

- ❍ High School Senior (1)
- ❍ Not in school but between 18 and 22 years old (2)
- ❍ College Freshman (3)
- ❍ College Sophomore (4)
- ❍ College Junior (5)
- ❍ I am younger than 18 or older than 22 (6)

D2 City & State. If a student, use home address.

City: (1)
State: (2)

D3 I come from a/an _____ area.

- ❍ Rural: No city with a population over 50, 000 within 20 miles. (1)
- ❍ Urban: living in a city with a population of 50,000 or more (2)
- ❍ Suburban: near a populated city (50,000 or more) but not within its official limits (3)

D4 Are you an international student?

- ❍ Yes (1)
- ❍ No (2)

D5 I am

- ❍ Male (1)
- ❍ Female (2)
- ❍ Transgender (3)
- ❍ Other (4)
- ❍ I prefer not to answer (5)

D6 Please indicate your parents' highest level of education

	No Education (1)	High School (2)	College Graduate (3)	Master's Degree (4)	Doctorate (5)	Click to write Scale point 6 (6)
Mother (1)	❍	❍	❍	❍	❍	❍
Father (2)	❍	❍	❍	❍	❍	❍
Other Guardian (if applicable) (3)	❍	❍	❍	❍	❍	❍
Click to write Statement 4 (4)	❍	❍	❍	❍	❍	❍

D7 Do you identify as multiracial?

- ❍ Yes (1)
- ❍ No (2)

D8 What is your race? (please mark all that are applicable).

- ❍ African (1)
- ❍ African American/Black (2)
- ❍ American Indian or Alaska Native (3)
- ❍ Asian (4)
- ❍ Asian American (5)
- ❍ European (6)
- ❍ White/Caucasian (7)
- ❍ Latino/Hispanic (8)
- ❍ Pacific Islander (9)
- ❍ Other (10)
- ❍ I prefer not to answer (11)
- ❍ Click to write Choice 12 (12)

D9 Below is a list of undergraduate majors grouped into general categories. Mark only one to indicate your probable field of study.

- ❍ Biological Science (1)
- ❍ Business (2)
- ❍ Education (3)
- ❍ Engineering (4)
- ❍ Physical Science (inc. Mathematics (5)
- ❍ Professional (nursing, health tech, pharmacy, phys. therapy) (6)
- ❍ Social Science (7)
- ❍ Technical (8)
- ❍ Other (agriculture, communications, law, military science) (9)

Q10 Use the drop-down menu to describe the following categories:

	Race		Background		Grew up in		Religion	
	are the same race as me (1)	are of different races (2)	have the same economic background as me (1)	have different economic backgrounds from me (2)	the same town as me (1)	are from a different town (2)	are of the same religion as me (1)	adhere to different religions than me (2)
The majority of my facebook friends (1)	❍	❍	❍	❍	❍	❍	❍	❍
The majority of my group of friends (2)	❍	❍	❍	❍	❍	❍	❍	❍
My more intimate friends (ones I spend most of my time with and share more personal information with) (3)	❍	❍	❍	❍	❍	❍	❍	❍
My academic environment (class student composition, professors/teachers) (4)	❍	❍	❍	❍	❍	❍	❍	❍

Appendix C

Epistemological Beliefs Inventory

1. Most things worth knowing are easy to understand.
2. What is true is a matter of opinion.
3. Students who learn things quickly are the most successful.
4. People should always obey the law.
5. People's intellectual potential is fixed at birth.
6. Absolute moral truth does not exist.
7. Parents should teach their children all there is to know about life.
8. Really smart students don't have to work as hard to do well in school.
9. If a person tries too hard to understand a problem, they will most likely end up being confused.
10. Too many theories just complicate things.
11. The best ideas are often the most simple.
12. Instructors should focus on facts instead of theories.
13. Some people are born with special gifts and talents.
14. How well you do in school depends on how smart you are.
15. If you don't learn something quickly, you won't ever learn it.
16. Some people just have a knack for learning and others don't.
17. Things are simpler than most professors would have you believe.
18. If two people are arguing about something, at least one of them must be wrong.
19. Children should be allowed to question their parents' authority.
20. If you haven't understood a chapter the first time through, going back over it won't help.
21. Science is easy to understand because it contains so many facts.
22. The more you know about a topic, the more there is to know.
23. What is true today will be true tomorrow.
24. Smart people are born that way.
25. When someone in authority tells me what to do, I usually do it.
26. People shouldn't question authority.
27. Working on a problem with no quick solution is a waste of time.
28. Sometimes there are no right answers to life's bigger problems.

Appendix D

Social Influences Survey

1. I was/am part of a close knit community where I grew up.
2. I feel threatened when challenged by new people or ideas.
3. My parents have a lot invested in me.
4. If I changed my mind about my beliefs, I'd lose a lot of friends.
5. If I accepted a person of difference, it would cause conflict with my family.
6. I make sure my dating partners have the same beliefs as me.
7. I grew up in a strict environment.
8. Sometimes you have to accept answers from teachers even if you don't understand them.
9. Learning depends most on having a good teacher.
10. I defer to religious leaders when I think about truth.
11. I feel a strong attachment toward my own racial/ethnic group.
12. My parents would be upset with me if I changed my mind about beliefs.
13. I rarely have doubts about my lifestyle or beliefs.
14. As a result of my experiences travelling in other cultures, I adjusted my beliefs.
15. My parents were/are heavily involved in my college decision.
16. When I have doubts about my beliefs or lifestyle, I talk to people at home about them.

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